Volume XXX Chicago, June 25, 1927 No. 13

Rock Products

With which is Incorporated CEMENT and ENGINEERING NEWS Founded 1896

Main street of the plant of the Phoenix Portland Cement Corp., Birmingham, Ala. Grinding plant and kiln house are at the left; laboratory, shops and offices at the right

General view of the plant from near crusher house

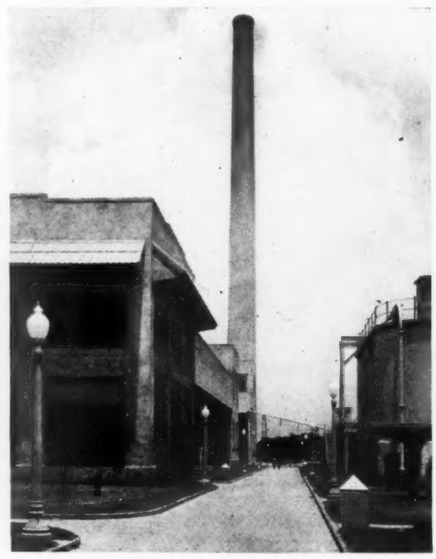
New Plant of the Phoenix Portland Cement Corporation at Birmingham, Ala.

Very Large Units, Advanced Methods of Control and Fine Appearance Are Distinguishing Features

RARELY has the building of a cement mill created so much interest as the building of the Phoenix Portland Cement Corp. plant, near Birmingham, Ala. The announcement that it was to have kilns 100 ft. longer than any that had yet been built was enough in itself to create much interest, and when it was further reported that the grinding mills were to be larger than any used in cement making, that the plant was to be entirely dustless, and that landscape gardeners and architects were being called in consultation, the interest deepened.

The plant has been in operation only about three months as this is written, but the visitors' book shows the names of many men well known in the cement industry (including some Europeans), presidents of companies, designers of well-known plants, and operating men. They have expressed their approval of the new plant in the most glowing terms and a number have said in effect that they considered it to be the finest cement plant yet built.

Whether this be true or not, Lindley C. Morton, the president of the company, says that he tried to build the finest plant that present knowledge of the art of cement making permitted. Yet in the carrying out of this intention there was no waste of money. Units were made large because large units are more efficient than small units. Grouping of machinery was studied intensively because proper grouping means a lessened cost for labor and supervision. And money was not wasted in *applying* ornamentation; such aesthetic value as the plant has was built into the design. The cost of the plant cannot be divulged, but it is known to be less per barrel of output than many plants both old and new. The keeping of the cost at or below the average figure, with the changes from standard practice which were introduced, is perhaps the greatest achievement of the builders.



Kiln house and stack

In spite of the changes that have been made, one sees that the plant design is not radically different from other plants. The changes have been evolutionary and not revolutionary. A good example of this is to be found in the very long kiln. Years ago long kilns were found to be economical; now the very long kiln is found to be still more economical. (At least two other companies are installing them and it is said that other companies are preparing to do so.) Every machine in the plant is a recognized cement plant machine, made by a cement machinery manufacturer. The difference is in the size of the machine and certain details of construction, such as the reduction of the pressure on bearings.

Four Principles of Design

Before designing was begun, Mr. Morton laid down four principles that had to be followed. These were:

(1) The plant must make the best cement possible under commercial conditions.

(2) To cut down man-hours, units should be large and the machines should be grouped to save in both labor and supervision.

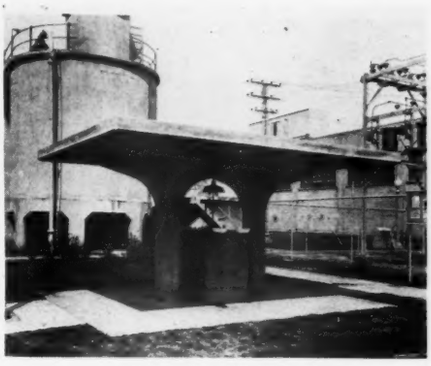
(3) Machines should be built and installed to lessen maintenance and repair costs as far as possible.

(4) Consideration should be given to aesthetic values, not only in appearance but in such matters as sanitation, freedom from dust, and comfortable working conditions.

The first principle now appears to be the ambition of every progressive cement maker. The second and third are sound principles of engineering, but the third has too often been neglected in the cement industry, in which costs for maintenance and repairs are known to be high. The fourth principle might not have been considered important a few years ago, but its importance is understood today. Every industrial engineer recognizes that orderliness goes with efficiency, that good working conditions call for self-respecting men, and that beautiful surroundings mean that machinery will not be neglected. As methods and machines become more standardized it is possible that this fourth principle may be moved nearer to first place, especially where plants are built in crowded centers of population.

In addition to laying down principles of design, a thorough study was made of existing plants. A party consisting of Mr. Morton, R. J. Hawn, vice-president in charge of operation, H. O. Underhill, superintendent, and R. E. Roscoe, supervising chemist, visited such of the better American plants as they had not already seen and the important plants of several European countries. Tendencies were noted as well as present practice. The idea of the very long kiln came from this trip (although nothing like it was seen) from noting the tendency in European practice to use longer and longer kilns.

Following this study, designing was begun under the direction of Mr. Hawn as chief engineer. Many preliminary layouts were considered which did not get past the stage of preliminary sketches, and three complete sets of plans were made, each intended to be final, but afterward abandoned because of developments



Drinking fountain in the center of the plant

that showed that another way would be better.

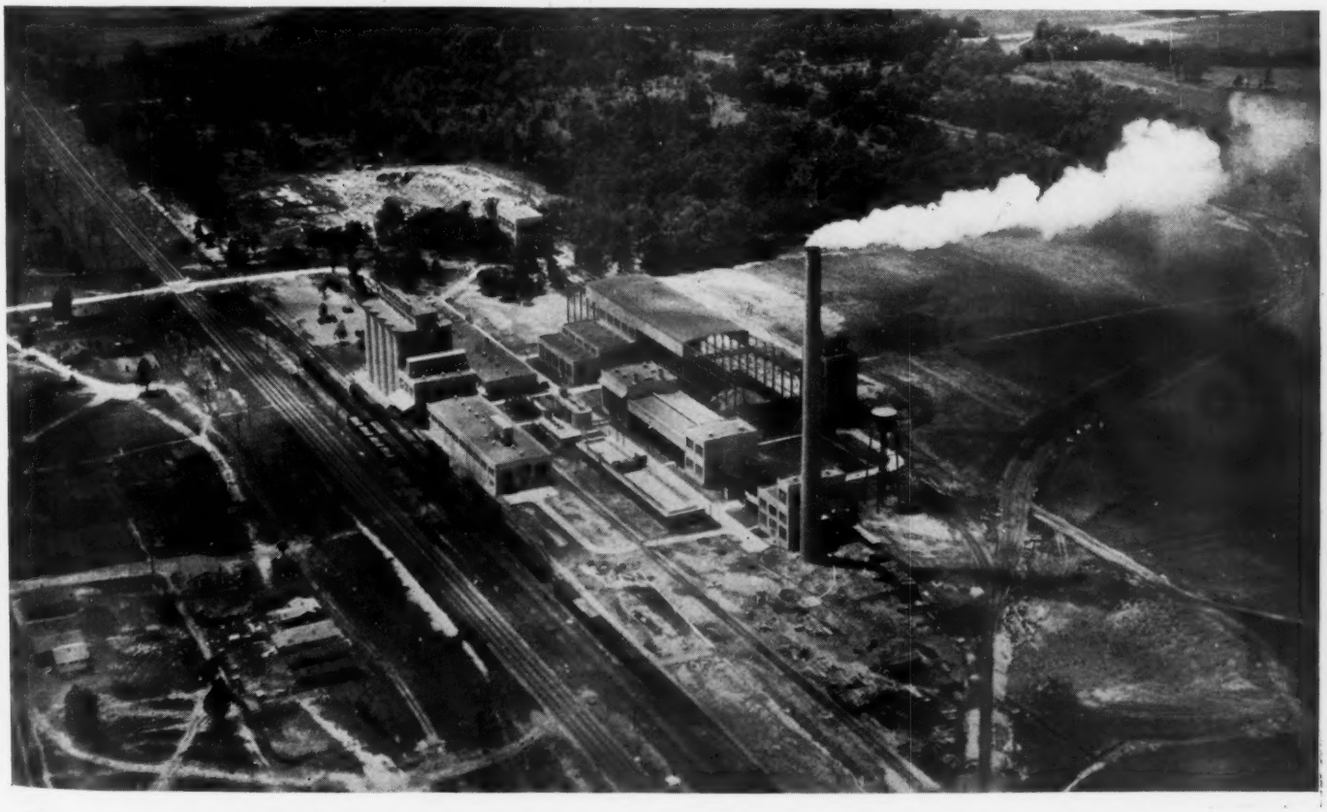
Plant Layout and Construction

All of the property on which the plant is built is underlaid with the limestone, which may be quarried or mined for raw material. In locating the plant the spot where the overburden was thickest was also found to be the highest point, providing drainage in four directions, and satisfactory for connection with the Southern and A. B. and C. railways. So this site was chosen.

The layout of the plant is not a straight line, but four parallel lines. The first is made up of the quarry, crusher house and stone storage, with the coal mill a little to one side. The second is formed by the grinding mill (raw and finish mills and power plant, all in one building) and the kilns and stack. The third line contains the auxiliary building, for offices, shops, warehouses and laboratory, the transformer yard and the slurry tanks and slurry mixing basin. The fourth is made up of the silos, packhouse and bag house. The arrangement is compact and at the same time there is ample space between the different units of the plant.

The main buildings are of steel frame with walls of "gunnite" concrete, this construction being preferred where machinery is installed. Large areas of the walls are of glass in metal sash to give plenty of light to the interiors. The walls of the auxiliary building are of "Slagtex" concrete tile made by the Birmingham Slag Co. This is faced on the outside with "gunnite" concrete to give an appearance uniform with that of the other buildings.

It will be noted from the pictures that there are no pitched roofs, which give such an unsightly appearance to many industrial buildings. All the walls are



This airplane view shows the layout of the plant in four parallel lines. Quarry and crusher house are in the trees in the upper center. This picture was taken before the landscaping of the grounds was completed

Quarry and incline to crusher. The cars run on a bench of broken rock as explained in the text

brought high enough to form a parapet which conceals the shallow slope of the roof and gives the building a clean, sharp profile against the sky. The roofs are all covered with concrete roofing tile, and covered with a Barrett specification roofing.

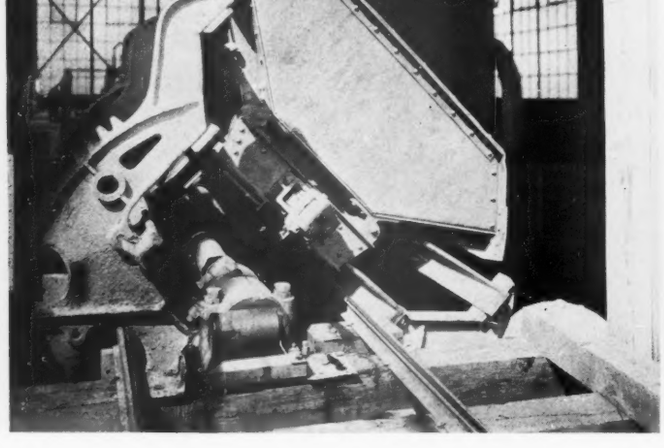
After the engineering drawings had been made they were turned over to an architect who set the depth of pilasters and attended to such other details as had to do with appearance. All the construction was done by the company which acted as a general contractor and sub-let contracts for various parts of the work. The silos were built by the Burrell Engineering and Construction Co., Chicago, the stack by the Rust Engineering Co. of Birmingham. All electrical equipment with a few exceptions in motors, mentioned later on, was supplied by the General Electric Co. Under the direction of Mr. Hawn, actual construction work was supervised by H. O. Underhill, who has had a wide experience as construction engineer in the United States and Mexico.

The kiln department was engineered by F. L. Smidth and Co. of New York and the kiln control was engineered by the electrical department of the same company.

The ground was covered with trees and in clearing it off for the plant as many trees as possible were spared. These fit into the general landscape gardening scheme, and other trees have been planted to complete it.

Quarry and Raw Materials

The quarry is in the Conosauga formation of the Cambrian system. The ledges



Quarry car in rotating car dumper

The car being dumped to primary crusher

around Birmingham are all folded and the ledge at this quarry pitches about 45 deg. Before any operations were begun the ground was systematically diamond-core drilled to a depth of 200 ft., developing enough limestone to keep the plant in operation for a century. Analyses of the cores showed the ledge as a whole to contain about 50% CaO, but the ledge as quarried naturally runs a trifle lower. A typical analyses of the rock as quarried is:

SiO_2	6.96%
R_2O_3	4.06%
CaO	48.21%
MgO	1.40%
Loss on ignition	39.35%
	99.98%

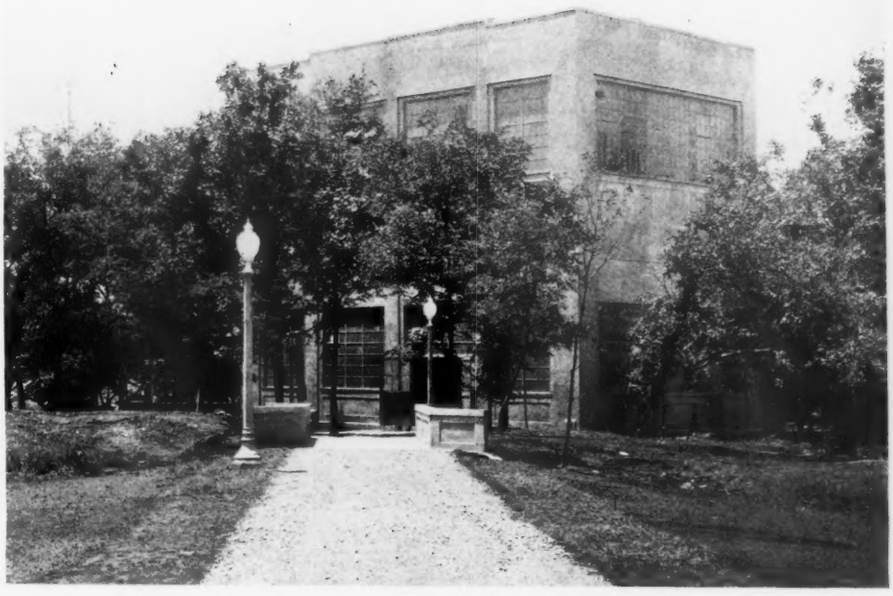
The other raw materials needed are sandstone and shale which are both quarried from the same quarry located a few miles from the plant and delivered by rail at a switching charge per car. Less than 10% of sandstone and shale combined is required to make the proper mix. The sandstone which is the main component after the limestone analyses:

SiO_2	87.04%
Al_2O_3	5.16%
Fe_2O_3	3.94%
CaO	0.20%
MgO	0.71%
Loss on ignition	1.47%
	98.52%

The shale analyzes:

SiO_2	58.60%
Al_2O_3	21.80%
Fe_2O_3	5.92%
CaO	0.50%
MgO	1.97%
Loss on ignition	7.63%
Undetermined	3.58%
	100.00%

At the limestone quarry, holes are put down 12 ft. apart by two Loomis-Clipper 6-in. well drills using the Gill bit, sharpened on the Gill machine. The holes are given about 20 ft. burden and are loaded with 75% gelatine at the bottom and 60% gelatine above. What little secondary shooting is needed is done with Ingersoll-Rand jackhamers. The broken rock is loaded into cars by a Type 100-B Bucyrus caterpillar electric shovel, with Ward-Leonard control, using a 2½-yd. dipper. This size shovel is used with a 4-yd. dipper in ordinary contracting work, but it was chosen to use with a 2½-yd. dipper in this case because it was judged that the maintenance and repair costs would be less than with a smaller machine.



The crushers are housed in this building, which is very well lighted and entirely free from dust

The quarry cars are the Phoenix type of 6-yd. capacity made by the Easton Car and Construction Co., and the locomotive which draws them to the foot of the quarry incline is a 9-ton, General Electric storage battery locomotive. This has a pull of 3200 lb., a speed of 3.5 m.p.h. and operates at 170 volts.

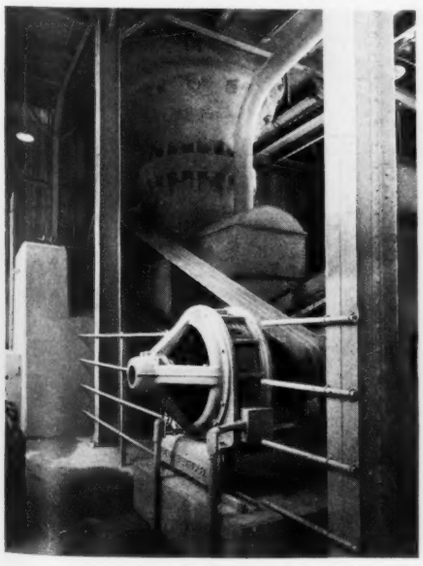
Method of Opening Quarry

The method of opening this quarry has been widely commented upon. It lies in a flat plain, and a usual method of opening a quarry in similar conditions is to start with a hole and enlarge it to give a circular face.

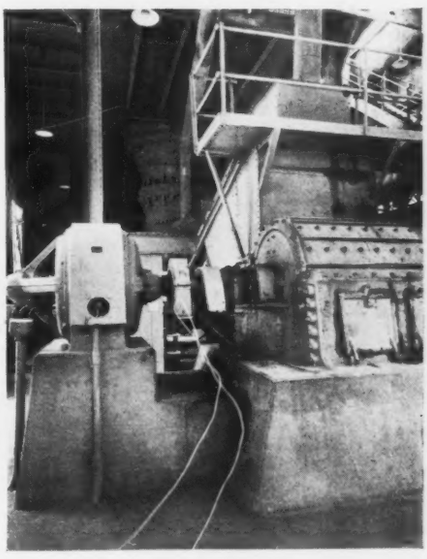
In this case lines of holes were put down for about 400 ft., 12 ft. apart and 35 ft. deep. After these were shot the shovel made a through cut, leaving a trench 400 ft. long and 16 ft. deep. The track for carrying the stone from this cut was laid on the surface. After this trench was dug the track was moved to the bottom, at one side. After the rock was taken out, a face 32 ft. high was left at one side, which is the working face of the quarry. The bench on the other side which was made of broken rock is now to be taken out and when this work is finished the quarry will have two parallel faces 400 ft. long and 32 ft. high and at the start these will be about 200 ft. apart.

This method of opening a quarry could hardly have been used (with shovel loading) before the introduction of the caterpillar shovel. A great advantage is that there is a heavy yield of stone from the beginning. The first set of holes shot gave 175,000 tons of rock and as it was shot in dead ground the fragmentation was exceptionally good.

Sixteen men in all are charged to quarrying and crushing operations and the production is from 1500 to 1800 tons of rock daily, a little more than 100 tons per man.



Primary crusher and drive. Note connection to dust collector



Hammer mill which reduces crusher discharge to mill feed

Electric shovel loading cars which are drawn in by storage battery locomotive

At the shale quarry Ingersoll-Rand tripod drills and jackhamers are used. The broken shale is loaded into Sanford-Day bottom dump cars and drawn to the shale crushing plant by a Vulcan gasoline locomotive weighing 7 tons, having four speeds and worm gear drive.

Crushing Plants

The limestone crushing plant is situated at the end of the quarry which is a little over 300 ft. from the group of main buildings. The cars are pulled up the quarry incline by a Steward Manufacturing Co.'s hoist connected to a 225-hp. motor, running at 300 r.p.m. and then run into a rotary car dumper of Steward make. This is of a type unusual in cement quarry practice, but it is much used in the iron ore mines around Birmingham. One feature of note is the control by a single short lever which simultaneously releases the brake and opens the switch so that whenever power is not being applied the brake is on. It is driven by a 10-hp. motor through a Falk herringbone speed reducer.

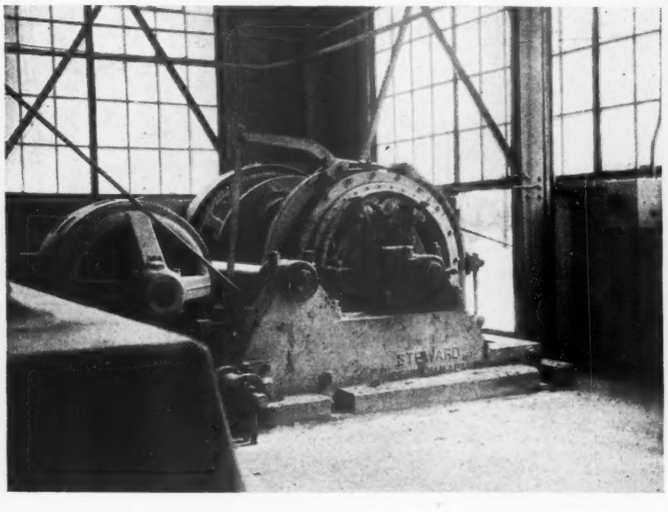
The rock falls directly from the cars into a 42-in. Superior McCully gyratory crusher made by the Allis-Chalmers Manufacturing Co. This is driven through a 26-in. belt by a 200-hp. motor. The crusher discharge falls on a 48-in. Link-Belt apron conveyor running 50 ft. per minute which is driven by a 15-hp. motor through a Falk herringbone speed reducer with a 112 to 1 ratio. The rock falls from it into a No. 9 Jumbo Williams hammer mill driven by a 380-hp. motor.

The discharge of this mill, 99% through ½-in., is the feed for the raw grind mills, and it is taken to them by a 30-in. belt conveyor running at 250 f.p.m. and driven by a 30-hp. motor through a Falk herringbone speed reducer. The belt is 330 ft. between pulley centers. The concrete trestle which supports it has been noted as one of the architectural features of the plant.

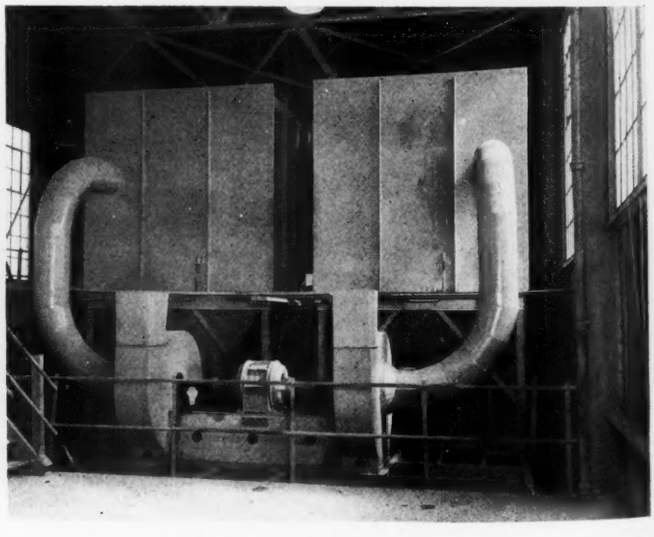
The crushing plant at the shale quarry contains a 20-in. McCully gyratory crusher, driven by a 60-hp., 900-r.p.m., slip-ring motor through a belt, and a No. 5 Williams Jumbo hammer mill, driven by a 150-hp. slip-ring motor at 1200 r.p.m. Connecting these is a 32-in. belt elevator, speed 110 f.p.m., driven by a 15-hp. motor and a Falk herringbone speed reducer with a 73.9 to 1 reduction. There is also a chain elevator for the finished product with 16-in. buckets driven by a 15-hp. motor through a reducer of the same make.

Looking down conveyor toward crushing plant

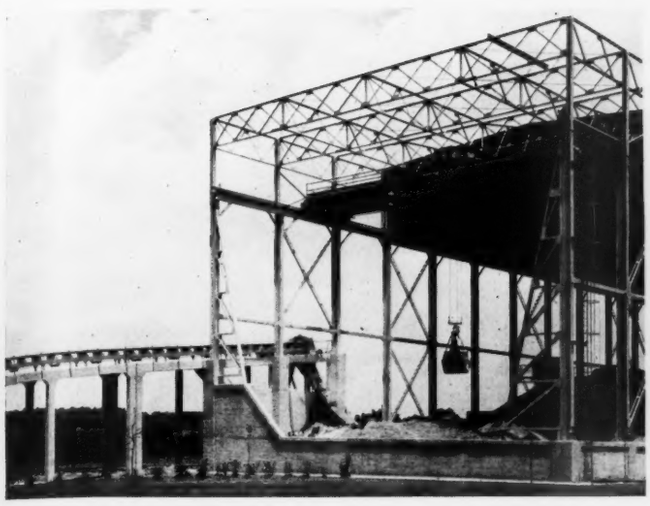
Shale and sandstone come to the plant in bottom dump railway cars and fall into a track hopper, 12 ft. square. They are lifted and discharged into the storage by a chain elevator of 43-ft. centers, with 16-in. buckets, which is driven by a 15-hp. motor through a Falk speed reducer.



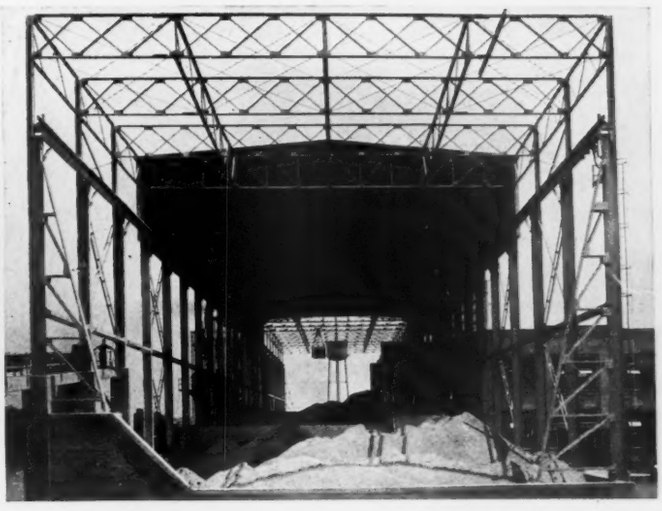
Hoist for pulling cars up quarry incline



Dust collectors in the crusher house



End of conveyor from crusher to stone storage

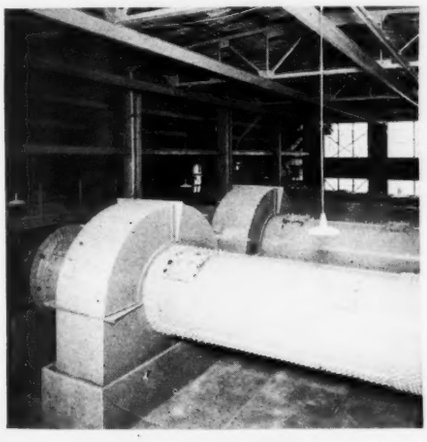


Looking through raw material and clinker storage

The air in the limestone crushing plant is entirely free from dust as a "Norblo" dust-collecting system is connected with every point where dust originates. This dust is discharged at intervals on the conveyor that takes the limestone to the stone storage.

Raw Material and Clinker Storage

The raw material and clinker storage is 460 ft. long and 80 ft. wide and divided by concrete partitions. There is a space about 90 ft. long for limestone, two small mixing



Feed end of mills

bins for sandstone and shale and spaces for storing sandstone and shale, which are about 25 ft. long. Beyond these are the clinker and coal storages, the two storages being placed end to end.

Materials are handled by two Whiting 3-yd. traveling cranes with 2½-yd. Blaw-Knox buckets, the cranes being purposely of a larger size than that needed for the buckets to allow for future expansion. One crane handles raw materials and the other coal and clinker. These cranes are heavily built and equipped with oversize motors to avoid maintenance and repair costs.

The gypsum bin is located in one corner of the clinker bin. Gypsum is brought in by rail from either Oklahoma or Virginia. The cars are unloaded into the boot of an elevator like the shale elevator except that it is of only 26-ft. centers.

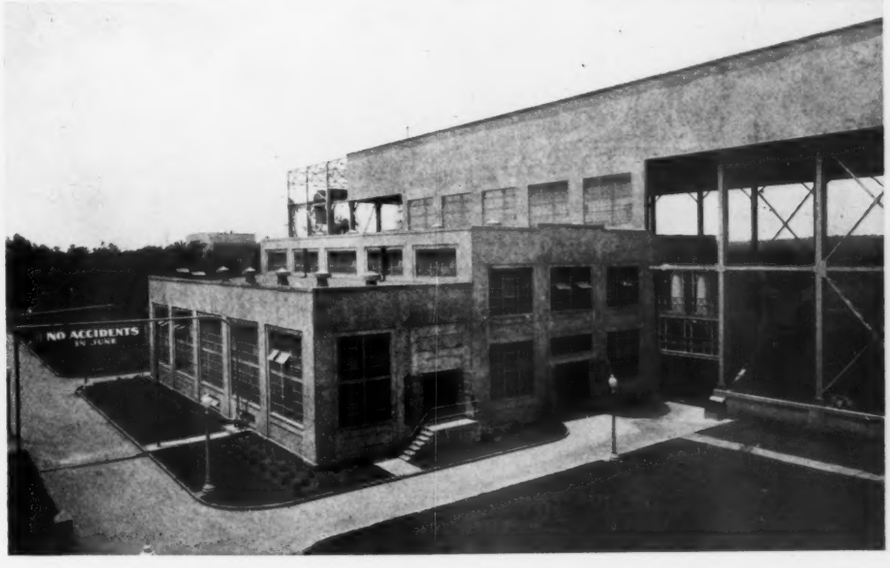
The raw materials are picked up by the crane and placed in the feed hoppers of the grinding mills. Each hopper is about 20 x 25 ft. and is divided by a partition on one side of which is limestone and the other shale. In the same line are two hoppers for the finish grind mills, of the same size and partitioned in the same way for clinker and gypsum. These hoppers are all over Schaeffer poidometers that act as feeders for the grinding mills.

Raw and Finish Grind Mills

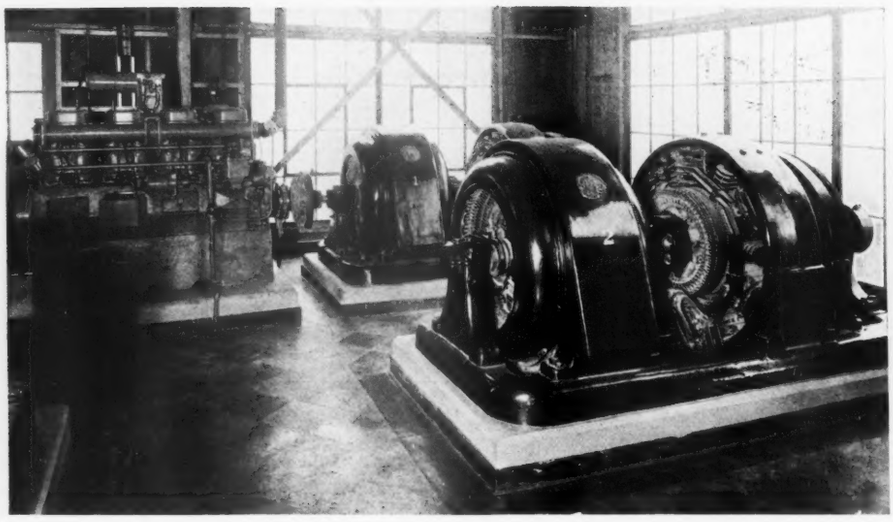
The grinding department is one of the features of this plant which has caused much comment on account of the large size of the mills and the combination of the grinding department with the power house. Of course this would not be possible if the room was not to be entirely free from dust, as it is. What has been gained by this arrangement is a considerable saving in man-hours. Two men and an oiler do everything connected with mixing, grinding and handling the slurry, in addition to the power house details, and they are by no means overworked. One man is on the poidometer platform and looks after the proportioning of materials and the amount fed to the mills, and the other watches the switchboard and the auxiliary machinery.

The room is of ample size to contain all the units and very well lighted and ventilated. The floor is of rubber tiling and all the machinery is painted gray and bright green. The fact that an open switchboard can be placed in this room is the best evidence of its freedom from dust. This condition comes from connection with a "Norblo" dust collector, placed just outside the mill house.

The four mills (all of the same size and type for both raw and finish grinding) are said to be the largest of their kind built for use in the cement industry. They are Allis-



The grinding plant contains raw and finish grind mills, compressors and the switchboard for the plant. Note dust collectors at right



Motor generators and stand by oil engine in grinding plant

Chalmers compebs, 40 ft. long. The first compartment is 9 ft. long and 8 ft. in diameter, and the remaining 31 ft., which contains the second and third compartments, is 7 ft. in diameter. Each mill is driven by an 800-hp. synchronous motor running at 180 r.p.m. through a 72-in. Cutler-Hammer magnetic clutch and Falk flexible coupling. The raw mills run at 24 r.p.m. and the finish mills are regularly operated at 19.9 r.p.m.

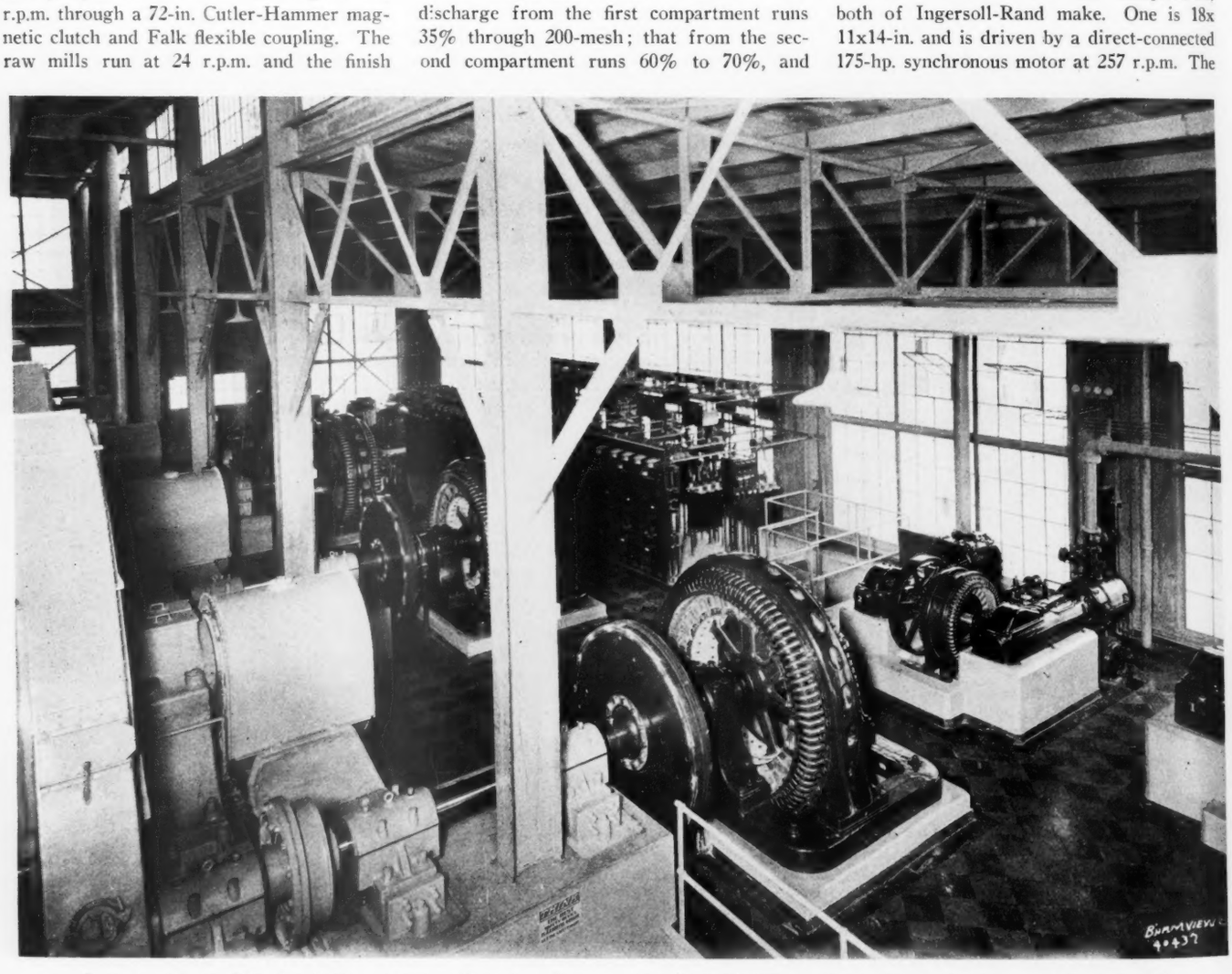
The grinding of the raw material is carried to an unusual fineness in these mills, as it averages 90% through 200-mesh. Tests have been made on the discharge of the different compartments which show that the discharge from the first compartment runs 35% through 200-mesh; that from the second compartment runs 60% to 70%, and that from the third 90%. The efficiency of the long third compartment in finishing the grind is noteworthy. The Conosauga limestone has been found unusually difficult to grind by all three of the plants in the Birmingham district that use it.

Forged steel balls are used for grinding in the first compartment and "concavex" balls and 5/8-in. "cylpebs" are used in the second and third. The cylpebs have been found especially efficient on this material.

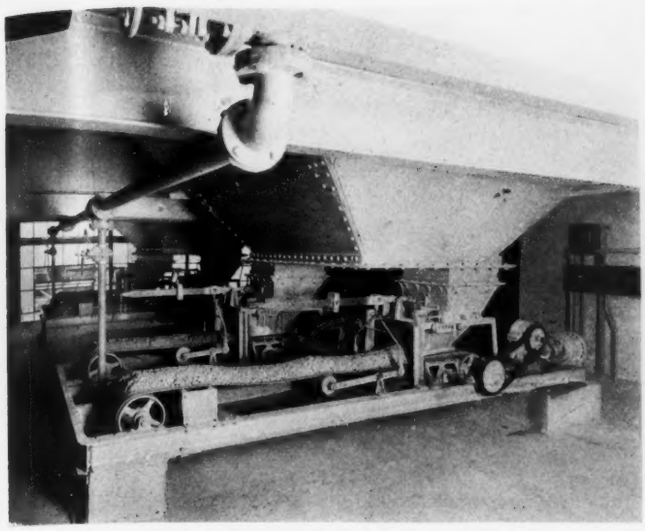
Both raw and finish grind mills were designed to have a large capacity over kiln requirements and actual operation has shown an excess capacity fully up to what was expected.

The discharge of slurry from the raw grind mills falls into a trough in which there is an agitator driven by a 10-hp. motor through a Falk herringbone speed reducer. It runs out of this through a pipe to two 4-in. Wilfley pumps, one of which is held in reserve. These are driven by 30-hp. motors running at 1200 r.p.m. with no speed reducer. These pumps send the slurry to the three mill tanks.

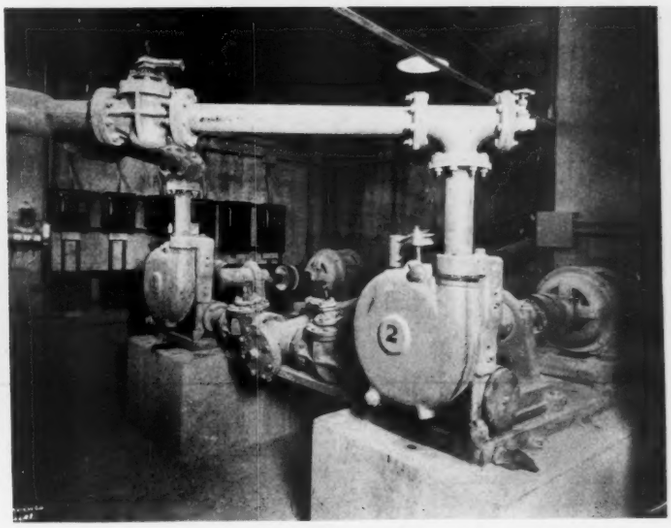
Besides the mills and the switchboard the mill room contains two air compressors, both of Ingersoll-Rand make. One is 18x 11x14-in. and is driven by a direct-connected 175-hp. synchronous motor at 257 r.p.m. The



Interior of combined grinding plant and power house; motors and clutches for mills in front, switchboard and air compressor in the rear



Poidometers feeding grinding mills



Pumps below raw mills for handling slurry

other is 15x9½x12-in. and it is driven by a 125-hp. synchronous motor at 277 r.p.m.

This room also contains two 435-hp. motor-generator sets (one as a reserve) which make direct current for the motors in the kiln house. One of these may be connected through a clutch to a 240-hp. Stirling gasoline engine to supply current to keep the kilns running in case the current from the power lines should be shut off.

A feature of the design of the large compeb mills that should be noted is that the bearings were made unusually large so that the pressure is brought down to 200 lb. per square inch.

Slurry Handling and Mixing

The slurry mixing and storage system of this plant is simple but of unusually large capacity. The three correcting basins that receive the slurry from the raw grind mills are 20 ft. in diameter and 20 ft. high. They discharge by gravity to a mixing basin which has the same capacity as all three correcting basins. From this the slurry is pumped to the slurry storage basin, which is 200 ft. long, 25 ft. wide and 21 ft. deep.

All these are of reinforced-concrete construction, and the correcting basins are set on concrete columns to raise them sufficiently to allow the slurry to flow into the mixing basin by gravity. All are fitted with F. L. Smidth & Co. agitators connected to a common shaft which is run by a 30-hp. motor through a Falk herringbone speed reducer. The mixing basin contains four Smidth agitators which are run from a common shaft by a similar motor and speed reducer.

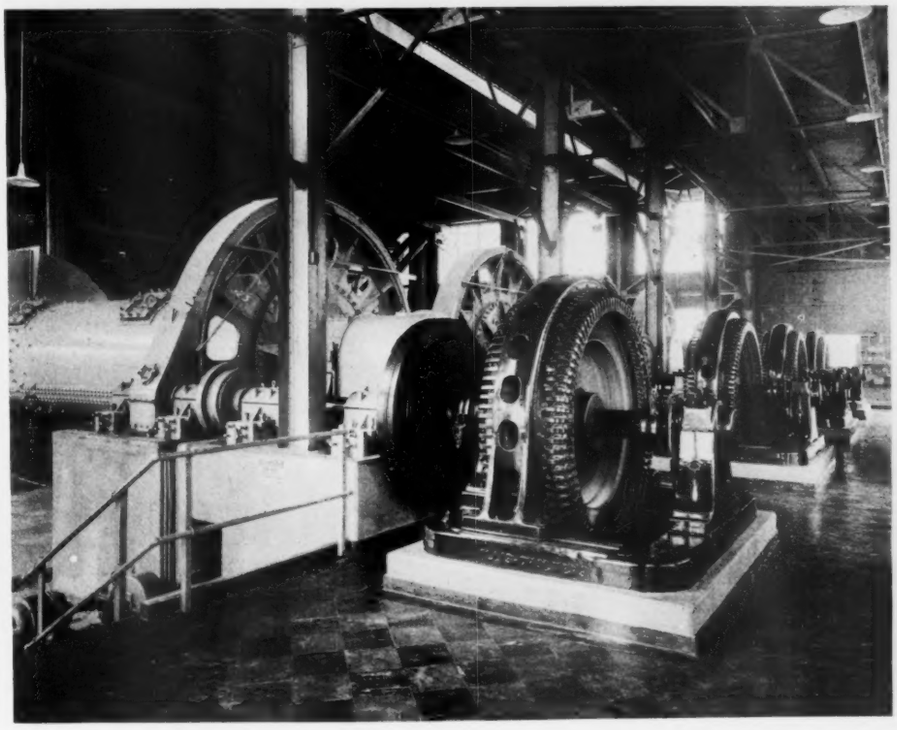
For transferring the slurry to the storage basin there is a Smidth air lift system with cylinders about 4 ft. in diameter. Air for this, and for the little air that is used in agitating, is supplied by a 7x10 Ingersoll-Rand air compressor, direct-connected to a 40-hp. motor running at 1200 r.p.m.

The big storage basin is a feature which is not yet found in many plants, although its use will probably increase as its advantages are better known. As it contains the material from three to four days milling it can be seen that any day's variation will be divided by a considerable factor when the slurry is added to the contents of the big tank. As the slurry is already corrected in the mixing basin before being pumped to the storage basin, the contents of the storage basin are bound to be remarkably uniform in composition, from the working of the law of averages.

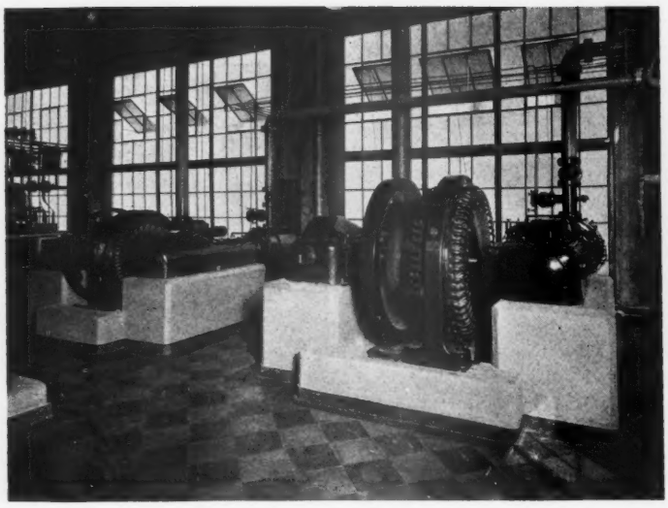
This storage basin is an F. L. Smidth device, and the Smidth traveling agitator is used in it. Ths consists of a frame on wheels which runs back and forth on rails on the edges of the tank. As the frame travels back and forth revolving agitating paddles thoroughly mix and agitate the tank contents. The solids in slurry settle at an almost imperceptible rate and this form of agitation is sufficient to keep them in suspension indefinitely. There are two motors on the framework, a 5-hp. motor with a Cleveland speed reducer for the travel of the machine back and forth, and a 10-hp. motor with a Foote Bros. speed reducer for driving the agitating paddles.

The action of the traveling agitator is entirely automatic, limit switches at the end of the travel reversing the motor. Current and air are supplied through a cable and a hose on one drum, the cable winding on as the hose winds off.

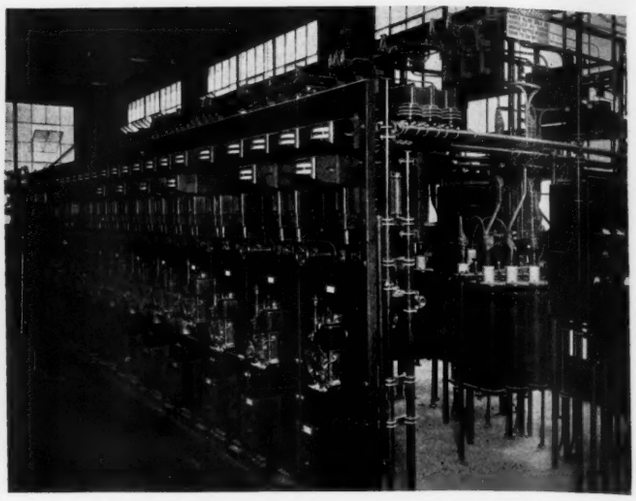
A little air is used in agitating the slurry storage basin. It is put in by four pipes, one in each corner, to agitate the only parts



One of the 40-ft. mills with its 800-hp. motor and magnetic clutch



Air compressors in grinding plant



Close up of plant switchboard

of the tank which the paddle agitator cannot reach.

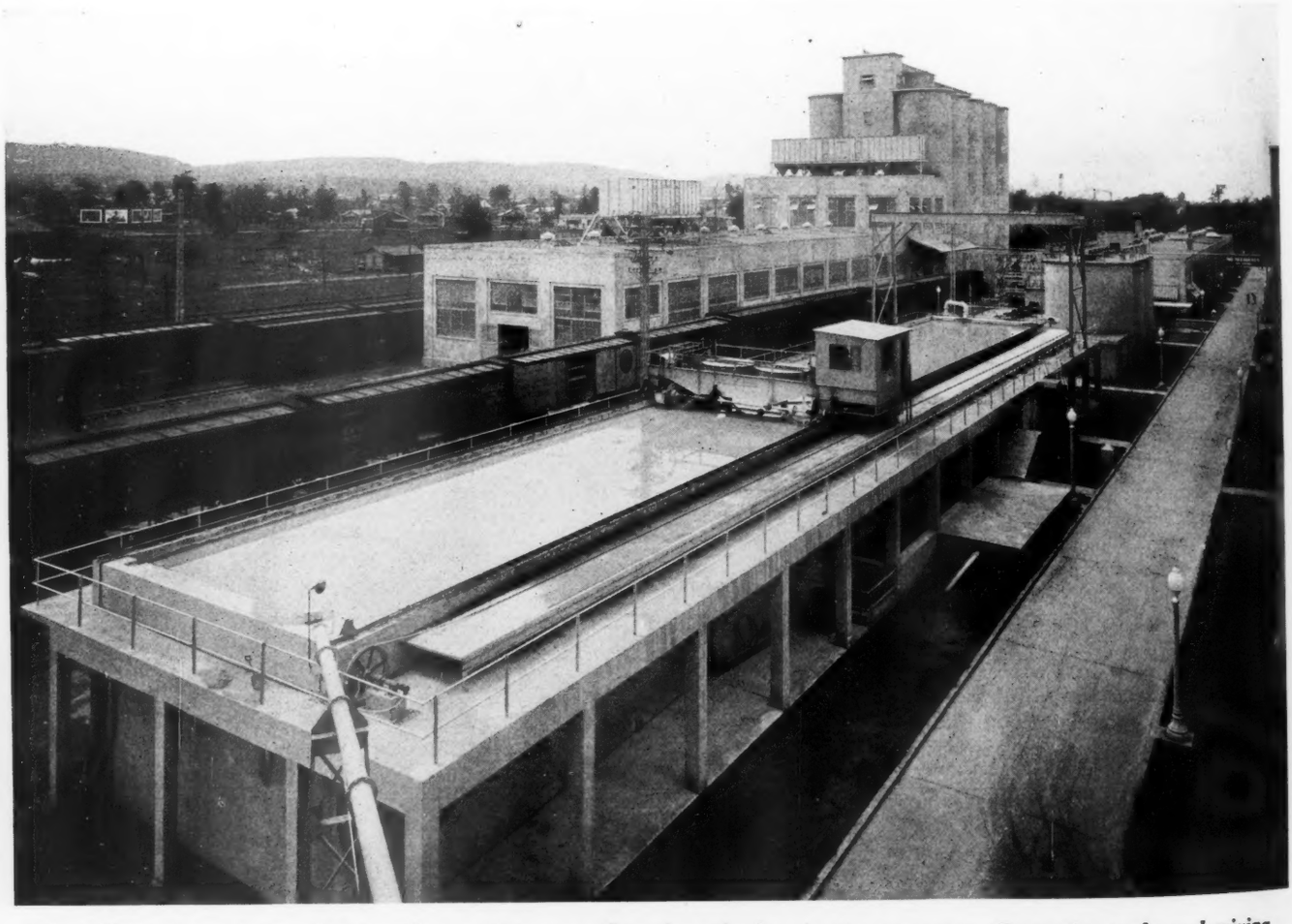
The slurry flows out of the storage basin into a long and narrow sump in which is an agitator of the horizontal type driven by a 15-hp. motor through a Falk speed reducer. The slurry is pumped from this by either of two 4-in. Wilfley pumps to the kiln-feed tanks, and the excess is returned by an overflow pipe to the storage basin. This aids in the mixing by giving a slow circulation to the contents of the basin. These pumps are direct-driven by 30-hp. motors.

The slurry feeders are of the scoop wheel type and each is driven by a direct-current motor with speeds between 600 and 1200 r.p.m. through a Falk speed reducer with an 82.2 to 1 ratio. They were furnished by F. L. Smidth and Co.

The water used for making slurry and other purposes comes from two Gould triplex pumps, each driven by a 20-hp. motor and furnishing 300 g.p.m. These are situated at the creek a short distance from the plant. There is also a connection to the city water mains.

The Long Kilns

It was at first decided to build the kilns 330 ft. long, but an addition had to be made



The 200-ft. slurry basin with traveling agitator; overflow from feeders is at near corner. Correction tanks and mixing basins show beyond and pack house and silos are in the background

for the Smidth "Unax" coolers. The actual length is 343 ft. 9 in. and 6 in. longer when hot. Some idea of the problems of support and mobility involved in their installation may be gained from the fact that each contains 1,100,000 lb. (550 tons) of steel. They were made by the Traylor Engineering and Manufacturing Co. in accordance with F. L. Smidth and Co.'s specifications.

Big as they are, no more horsepower is required to turn them than is required by many kilns of ordinary size. They are driven by 100-hp. direct-current motors (speeds 450 to 1000 r.p.m.), but actual measurements of the power consumed show that only 60 hp. is all that is actually required.

The three correction basins

The drive is through a train of cut steel gears.

Part of this low power consumption is due to the facts that the single-roll kiln support is used, and that the cut steel gears require less power than some other transmissions. But the main reason for low power consumption is in the careful balancing of the kiln on its supports. There are five of these supports, each consisting of a ring and rollers about 3 ft. wide on the face. The bearings of these rollers have been made large enough so that the bearing pressure is about 200 lb. per square inch, or about two-thirds of what some authorities say may be used.

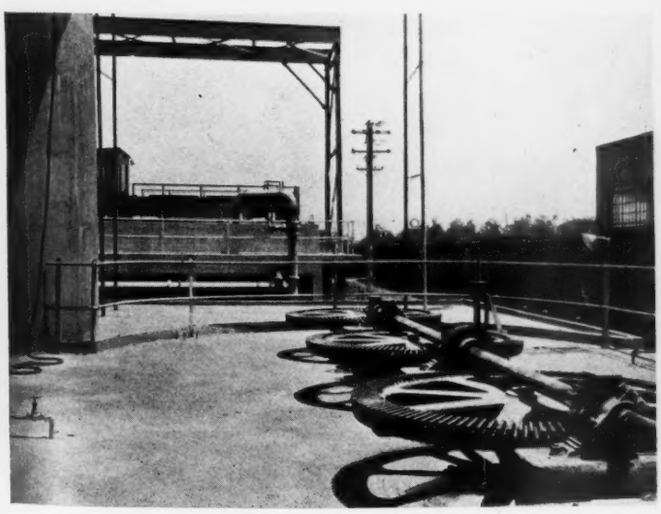
Correcting basins and mixing basins. An air-lift system, air compressor and slurry pumps housed in the building in front

The diameter of the kilns is 11 ft. 3 in. for 120 ft., at the hot end, and 10 ft. for the remainder of the length.

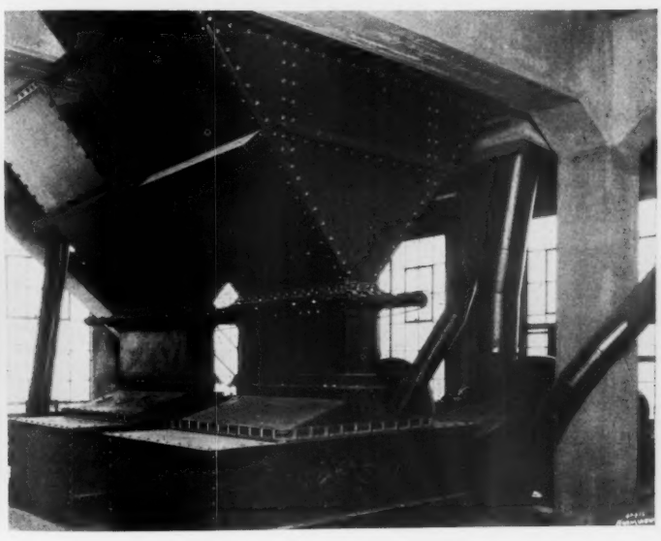
In the first 112 ft. of the feed end there are 4000 ft. of ⅞-in. chain suspended in loops. This is one of the features which has been much discussed. Contrary to the general opinion, the main purpose of these chains is not to agitate the slurry and break up lumps, but to transfer heat. They act in the same way that the checker-work does in a regenerative furnace, taking heat from the hot gases and giving it up (in this case) to the slurry. They have a further advantage in acting as dust collectors, for the colder loops of the chain covered with drying slurry form an excellent air filter to which any particles of dust will adhere. That both these uses of the chain are something more than theoretical is shown by the low temperature of the stack gases and the small amount of dust that is collected. No appreciable amount of dust escapes through the stack into the air. This chain system is patented by F. L. Smidth and Co.

With such a long kiln extra care had to be taken to provide for the thrust due to expansion. The thrust ring is placed in the center of the kiln so that the shift due to expansion is cut in half. The edge of the ring is beveled and runs between two disks with beveled edges. Each disk is 4 ft. 2 in. in diameter and is mounted on a vertical shaft 24 in. in diameter.

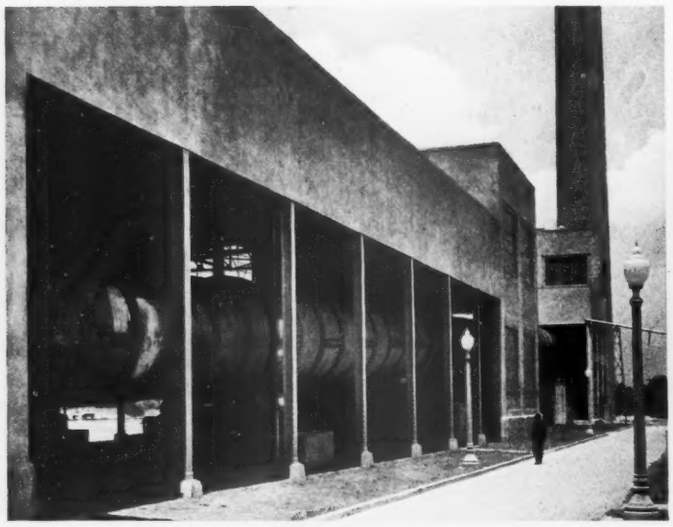
The draft for each kiln is controlled by means of two Buffalo Forge Co.'s duplex conoidal fans. Each fan is direct connected to a 40-hp. adjustable speed motor, 300 to 600 r.p.m. controlled from the burner's



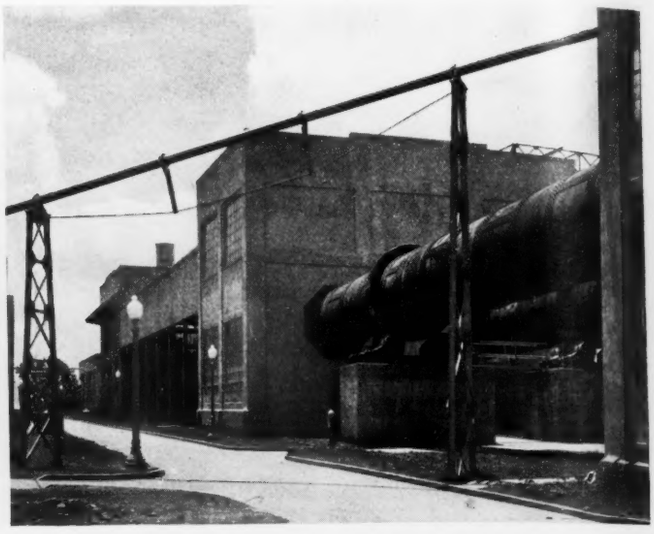
Agitation gears on top of mixing basin



Upper part of vertical coal dryers



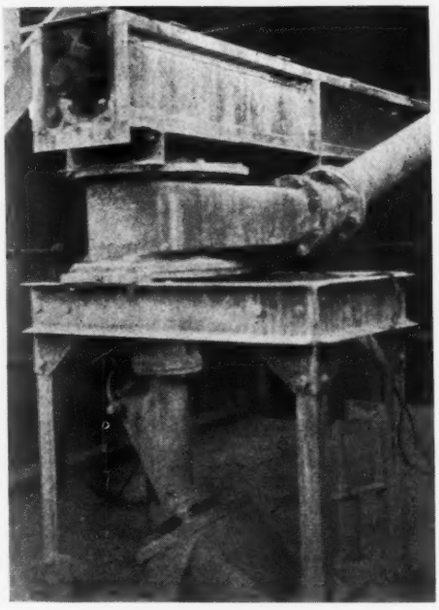
Kiln house looking toward the stack



Kiln house looking from the stack end

platform. One fan is sufficient to handle all the gases, in case of repairs to one fan, but is, under those circumstances, not working as efficiently as the two fans in parallel operating at a lower speed. Inasmuch as the fans are not designed to stand a temperature of more than 700 deg. F., it was decided to install a fresh air damper in the smoke chamber so as to admit sufficient air to lower the temperatures of the gases. F. L. Smidth and Co. designed an entirely automatic control for this purpose consisting of Foxboro thermometers actuating electric contact when the temperatures of the gases had reached certain upper or lower limits. These contacts in turn energized relays acting on a solenoid controlled three-way valve admitting water to the upper or lower part of a hydraulic piston which in turn is, by means of ropes and sheaves, connected with the damper. In this way the temperature of the gases entering the induced draft fans will be maintained within the desired limits. Signal lights on the control board on the burner's platform indicate the proper functioning of this device.

The draft is first downcast in a sheet steel chamber for collecting dust and then upcast to a flue that goes to the stack. Under these chambers, and under the flues, are screws for removing any collected dust; a 5-hp., a 10-hp. and a 15-hp. motor run these screws as they are required. Falk speed reducers are used with all of them. A 12-in. dust elevator of 59-ft. centers, run by a 15-hp. motor and Falk speed reducer, takes this dust to a screw and the slurry feed.

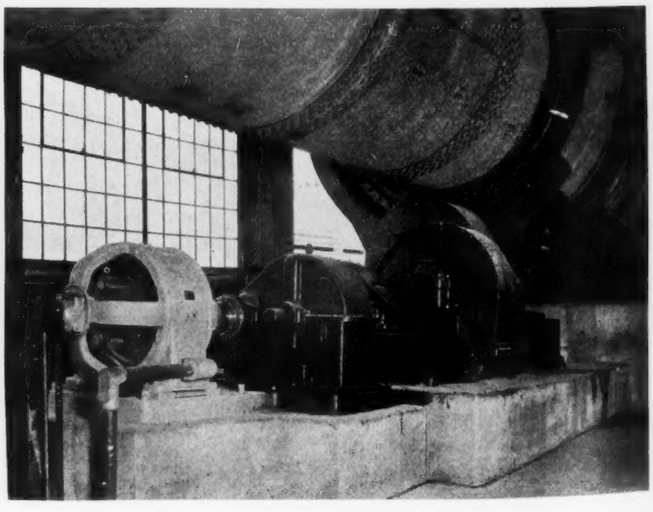


Where dust is added to the slurry as it enters the kiln

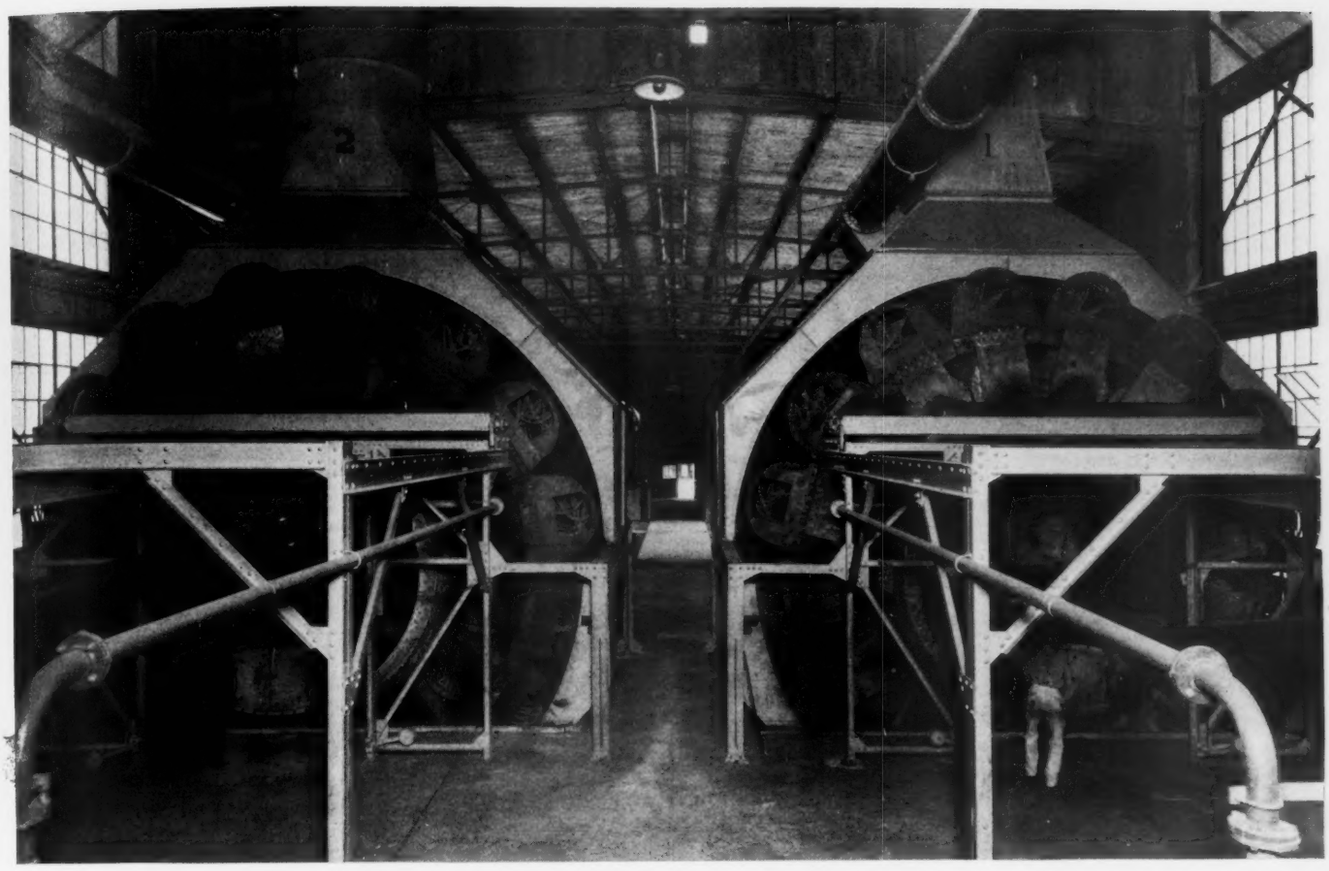
The stack is 293 ft. high and 20 ft. in diameter at the base inside. It has sufficient draft for the operation of the kilns without the fans, should this be necessary. The purpose of the fans is to maintain uniform conditions of draft through all changes of temperature and direction of the wind.

The temperature of the kiln gases, which may vary from 600 to 700 deg. F., is measured at the mouth of the kiln by means of thermocouples. A Leeds and Northrup Co. indicating type of potentiometer is located on the control board at the burner's platform, and a graphic recording type of potentiometer is located in the superintendent's office and graphically records the temperatures of the gases leaving the two kilns. The draft

The central thrust bearing that takes care of expansion



Motor and cut gear train that drives kiln



Fire end of kilns showing the coolers, the double row of tubes surrounding the end of the kiln. The chains shown act as transferrers of heat

in the smoke chamber is indicated by Republic Flow Meter Co.'s dial draft indicators and shows 1½ to 2 in. of water column.

The kilns were designed to have a capacity of 2000 bbl. per day and produce this without being crowded. As much as 2100 bbl. has been turned out in a day's run.

Coolers

The Smidth "Unax" coolers of these kilns are the first of the double cylinder type to be built. The action will probably be better understood by looking at the picture than by a written description. Each cooler consists of a double row of tubes placed around the fire end of the kiln. Holes in the kiln connect with the inner row and allow the hot clinker to enter. After being cooled in the first inner tubes the clinker passes to the outer tubes where it is further cooled and then it is discharged to a Smidth "Skipulter," or shaking conveyor, that discharges it into the clinker storage.

Each tube is 14 ft. long and 3 ft. in diameter and contains loops of ⅞-in. chain, the same as the loops in the kiln. The purpose of the chain is to act as a heat transferer, but the heat in this case is transferred to the air passing through the cooler. All the air entering the kiln is drawn through the cooler with the exception of that which is fed in with the powdered coal. Even this is somewhat preheated by the coolers, as the suction of the coal fan is connected with the hood around the coolers so that the air takes up some of the radiant heat from them.

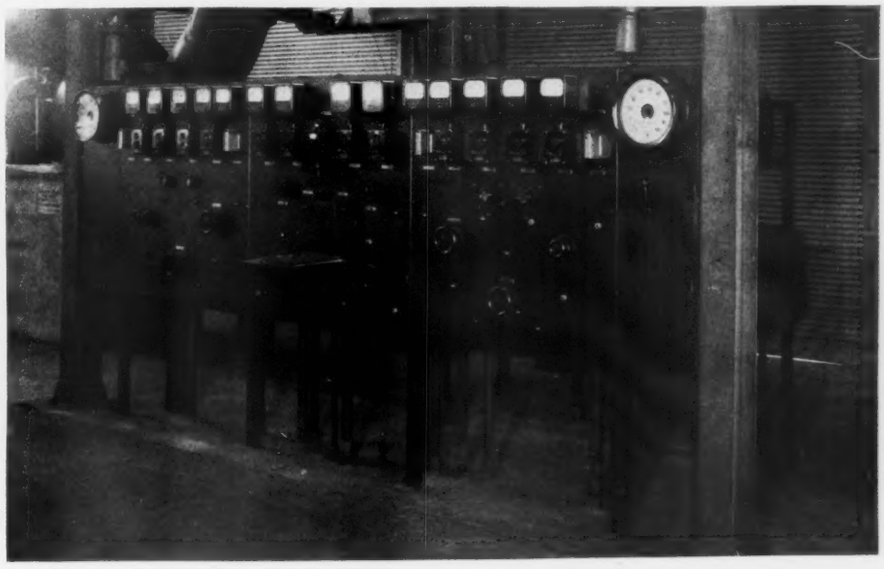
As the air in entering the kiln has to pass through these coolers, the pressure shown on the draft gage at the entrance is higher in kilns without this type of cooler. Ordinarily 0.30 in. of water is registered.

The kilns are lined with "Arco-frax" brick (made by the General Refractories Co.) in the burning zone. The remainder is lined with Harbison-Walker 6-in. "Special" fire brick. Between the brick and the shell is a 3-in. lining of Moler insulating brick, of Danish manufacture. The coolers are not lined.

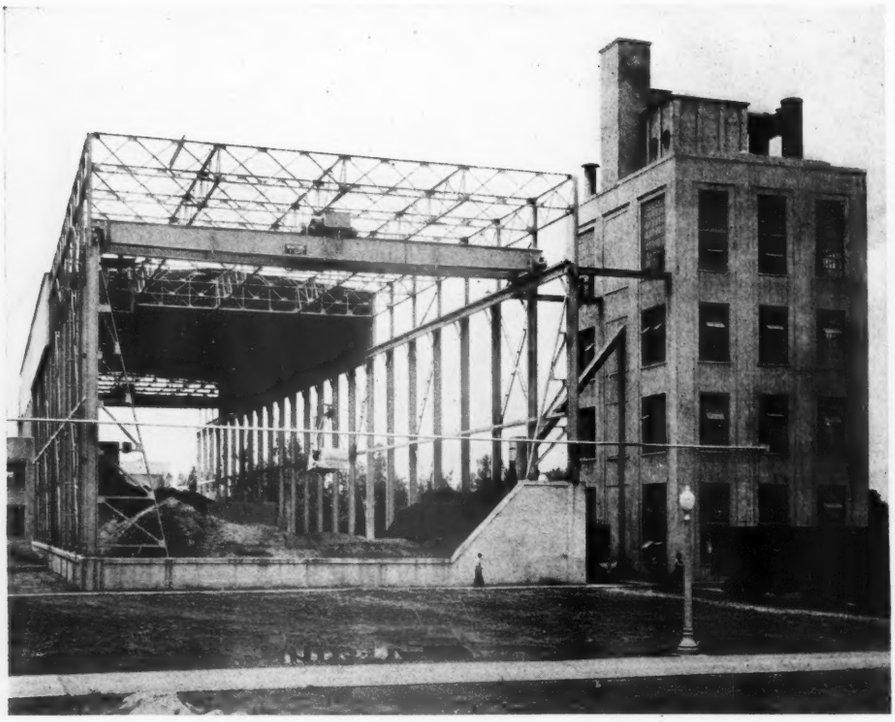
The clinker is cooled to about 240 deg. F. in passing through the coolers. It is further cooled in the "Skipulter" conveyor to about 175 deg. as it enters storage.

Centralized Kiln Control

The numerous motors and instruments en-



The kiln control board from which the feed and every operation connected with the kilns may be controlled



The coal mill at the end of the clinker and coal storage

tering into the control of kilns of this size and the relatively great distances between the burner's platform and these various devices make it desirable to use remote control for all motors and remote indication of instruments, all centralized at one point and conveniently arranged for the kiln operator. For this purpose a special control switchboard with various auxiliary devices was designed and built under the supervision of the electrical department of F. L. Smidth and Co. This control board is about 15 ft. long and consists of a number of slate panels on which are mounted the 50-odd instruments, signal lamps, magnetic counters, pushbutton stations and rheostat handwheels for the control of the two kilns. Aside from the alternating current and direct current power wiring, over 150 signal and control wires terminate in the conduit box extending the full length of this control panel. In the center is located the above mentioned Leeds and Northrup potentiometer with two pushbuttons, one for each thermocouple of each kiln. Above this is found a red signal lamp controlled by a device indicating normal return flow of slurry from the two scoop feeders. Symmetrically on each side of this potentiometer are mounted the various instruments and other devices, those to the left for the one kiln and those to the right for the other kiln. Starting at the center the instruments for each kiln are arranged as follows:

Ammeter, stop-start pushbutton station, and field rheostat for d.c. coal blower motor.

Ammeter, stop-start pushbutton station, and field rheostat for d.c. coal screw motor.

Ammeter, stop-start pushbutton station, and field rheostat for d.c. kiln motor.

Weston speed indicator showing r.p.m. and Veeder magnetic counter showing total revolutions of kiln.

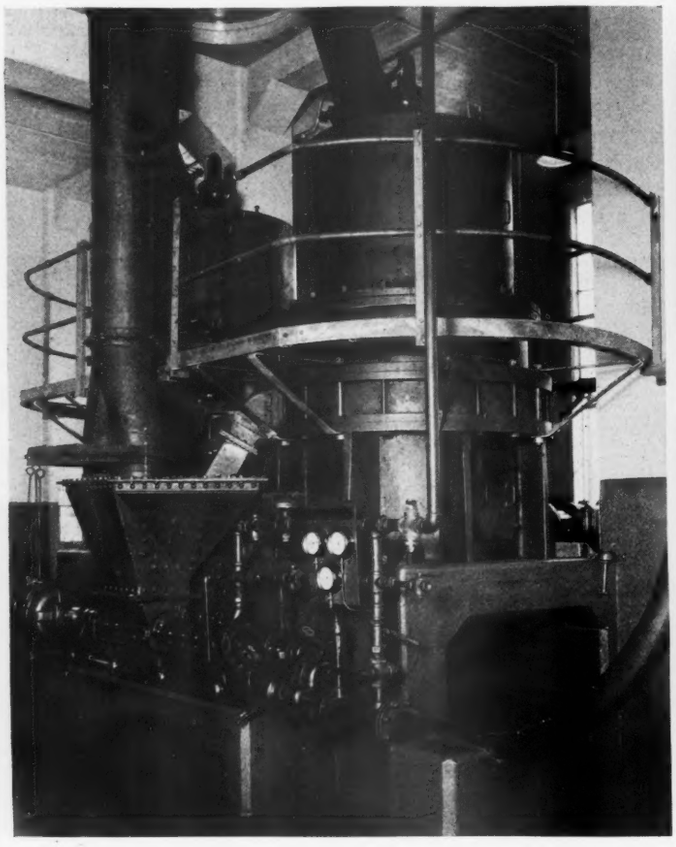
Ammeter, stop-start pushbutton station, and micrometer rheostat for induced draft fan "A."

Ammeter, stop-start pushbutton station, and micrometer rheostat for induced draft fan "B."

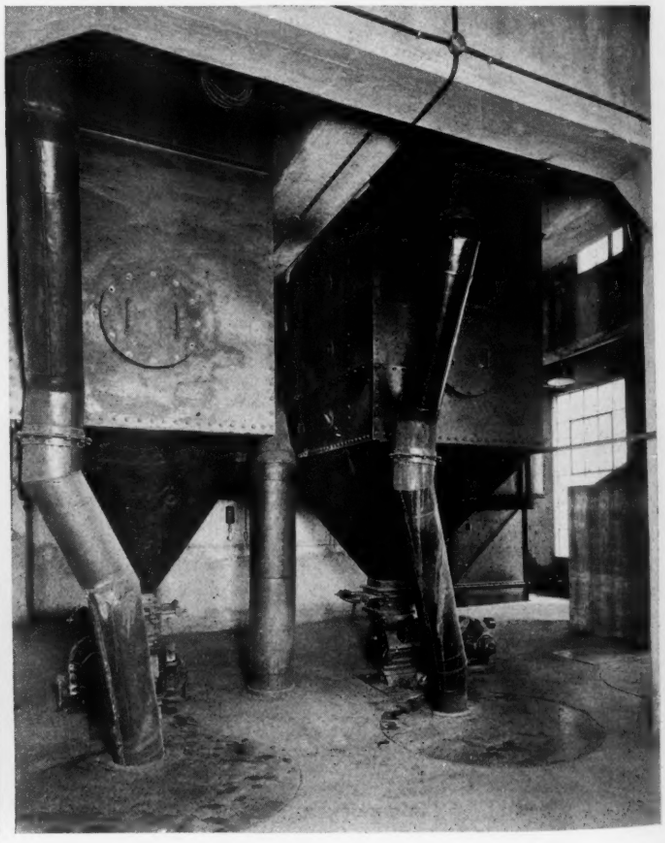
Twin main field rheostats for fans "A" and "B."

Weston speed indicator showing rate of slurry feed.

Veeder magnetic counter showing total revolutions of feeder, stop-start pushbutton



Coal mills and pneumatic pump handling the powdered coal



Lower part of coal driers and feeders for coal mills

station, and field rheostat for d.c. adjustable speed motor driving slurry feeder.

Red signal lamp indicating when automatic damper protection is acting.

A Republic Flow Meter Co.'s dial draft indicator showing the draft at the burning zone.

Interlock relays tying the kiln motor and the slurry feed motor together, as well as the motor driving the coal blower and the coal screw, are provided as a safeguard and convenience for the operator. This interlock system may be thrown on or off by means of small control switches.

Besides the standard equipment of instruments and other devices, forming the integral part of the control board, it was found necessary to get up special devices to meet certain requirements. The special gear box and contact-making device for the operation of the Veeder magnetic counter is one of these devices. The problem was to get an accurate contact-making device so arranged that it would be impossible to tamper with the recorder. A solution was found in a small gear box with triple worm drives, with a total ratio exactly like the gearing between the kiln and the kiln motor. The magneto for the Weston speed indicator giving the r.p.m.'s of the kiln or kiln motor is also located inside the padlocked steel box containing these gears and contact-making drum switch. The shaft of the gear box is connected with the kiln motor by means of a flexible coupling.

Coal Mill

Coal is received in railway cars which empty into a track hopper. This hopper extends into the coal storage so that the crane can either take coal from it or put coal into it.

From the hopper the coal is elevated to the dryer bins by a Bartlett & Snow automatic skip hoist with 60-cu. ft. buckets. It has a capacity for 40 tons per hour and runs entirely without attendance.

The two rows of silos and end silos enclose a large storage bin

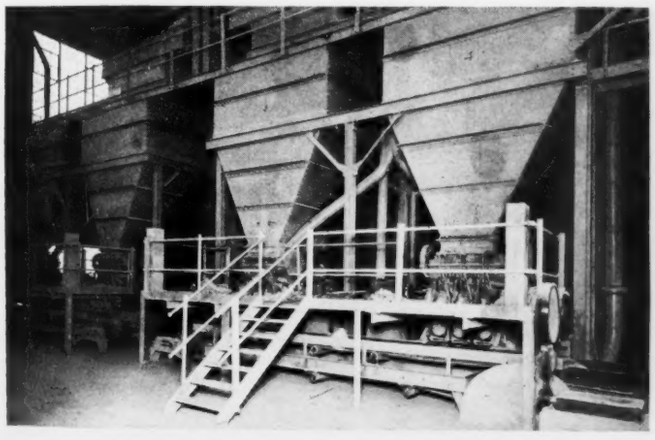
The dryers are the Fuller-Randolph vertical type in which the coal settles down in a shaft pierced with tunnels, or flues, through which the hot gases pass. Heat is supplied by a furnace at one side, fed by a Riley-Jones stoker furnished with a blower driven by a 2-hp. motor. The coal is drawn out of the dryers by the feeders of two 46-in. Fuller-Lehigh mills, each direct-connected to a 100-hp. motor. Two Buffalo fans, each with a 40-hp. motor, send the dust from these mills to 8-ft. cyclones above.

The pulverized coal from both mills goes to a 6-in. Fuller-Kinyon pump connected to a 20-hp. motor running at 900 r.p.m. This sends the coal to the hoppers of the kiln feeders through a 5-in. pipe line.

Each coal hopper is about 10x15 ft. Below it is a 6-in. double flight coal screw driven by a 5-hp. d.c. motor, with speeds from 600 to 1800 r.p.m., through a Falk reducer.

The fans by which the pulverized coal is fed into the kilns were made by the Buffalo Forge Co. and are of the conoidal type. The coal pipe is carried into the kiln about 14 ft. to leave a space for the operation of the "Unax" coolers.

The coal screw has long bearings which are provided with a grease seal to prevent the admission of air through the bearings. No trouble from flooding of the pulverized



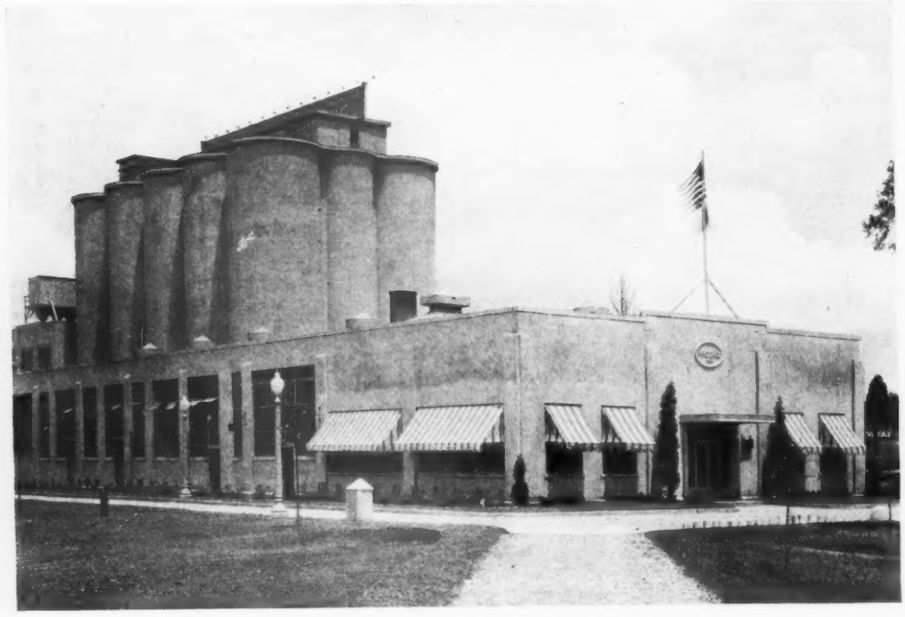
Packing machines in the pack house

Bag sorting belt and bag cleaner

Machine shop and blacksmith shop which are in the auxiliary building

coal has been experienced at any time.

The coal mill is just as dustless as any other part of the plant. The plant has no separate dust-collecting system installed, but the connection of the various parts is such that all the dust made is caught by the fans and cyclones. The walls have been painted a light color and show no sign of coal or other dust.



The long auxiliary building which contains offices, shops warehouses and laboratory

Grinding Clinker and Storing and Packing Cement

The two finish-grind mills are in the same mill room as the raw grind mills and under the same workers' supervision. They are duplicates of the raw grind mills in every respect, including motors, clutches and method of feeding, except that the two poidometers which feed the mills handle clinker and gypsum in the place of limestone and sandstone with shale.

Grinding is carried about 10 points finer than specifications demand, that is, to 88% passing 200-mesh. Forged steel balls are used in the first and second compartments and 5/8-in. slugs and cylpebs in the third.

The discharge from the finish grind mill goes to a closed trough in which there is a 14-in. screw driven by a 5-hp. motor through a Cleveland speed reducer. This screw discharges to a second 14-in. screw driven by a similar motor and reducer, which takes it to two 6-in. Fuller-Kinyon pumps each driven by a 75-hp. motor. These pump the cement to the silos through a 5-in. pipe line, one pump being a reserve.

There are ten silos, 25 ft. inside diameter and 80 ft. high, arranged in two parallel lines. At the ends the space is closed by two silos, 16 ft. in diameter, of the same height. Thus the space between the lines of silos is made into a single large bin which is approximately 90 ft. long and 20 ft. wide. The total storage capacity is 150,000 bbl.

The cement is removed from this storage by three lines of screws in parallel. Two pass under the lines of 25-ft. silos and the third passes under the big center bin and the 16-ft. silos on the end. Each is driven by a 30-hp. motor through a Falk reducer. They deliver to two shorter screws at right angles, each driven by a 10-hp. motor through a Cleveland reducer, to two enclosed chain elevators, 51-ft. centers, each driven by a 30-hp. motor and reducer. These discharge into the bins of two Bates valve-bag packers.

Beyond the packers is the baghouse, which is a building 200 ft. long and 60 ft. wide. Besides the bag storage, it contains a sorting belt of 40 ft. driven by a 5-hp. motor through a James reducer. Bags are cleaned in a Nazareth bag cleaner which is fed by a 30-in. belt conveyor driven by the same 20-hp. motor that drives the bag cleaner, through a Falk reducer.

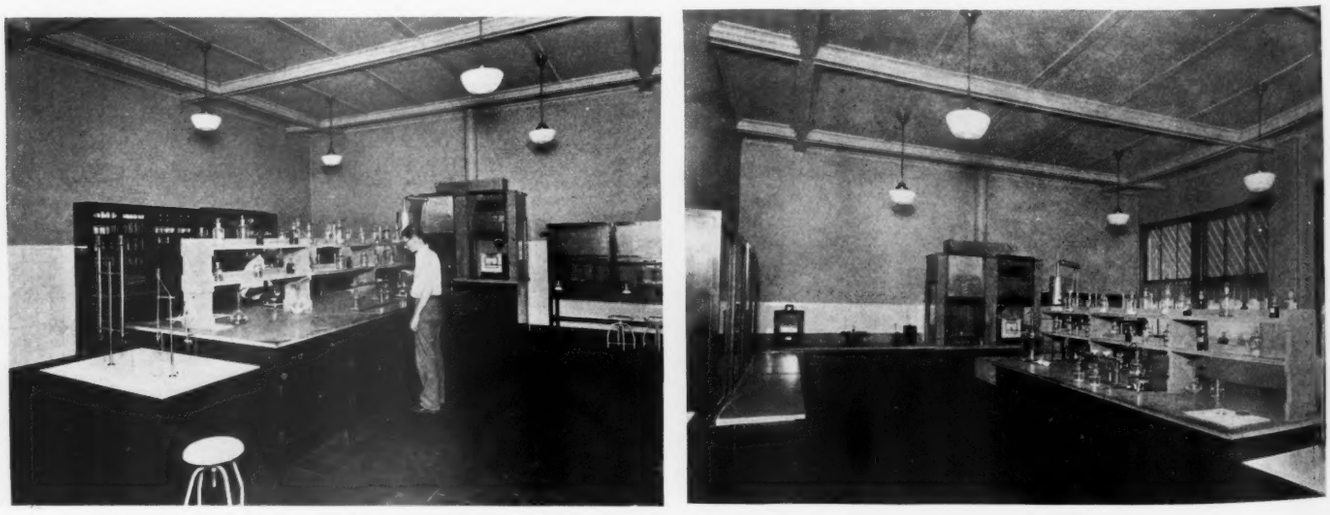
There is a short dust-collecting screw under the bag cleaner and this discharges into a 9-in. dust screw almost 200 ft. long that runs through the baghouse and into the screws that feed the cement elevators. It is driven by a 10-hp. motor through a Falk reducer. The discharge of the cement elevators is passed over a screen before it enters the packer bins. The cement elevator motors drive the clean-up screws under the packing machines.

The air in the baghouse is as dustless as it is elsewhere in the plant, and it is kept so by a "Norblo" dust collector which is placed on the roof. Another "Norblo" collector is placed above the packing machines.

A short bag elevator driven by a 5-hp. motor raises the sacks from the baghouse floor to the packers.

Auxiliary Building and Laboratory

A single, one-story building 346 ft. long and 60 ft. wide, called the auxiliary building, contains all the activities which are indirectly connected with the making of cement. Beginning at the end farthest from



Chemical laboratory. All the cabinets are of enameled steel

Physical laboratories in which cement, aggregates and concrete are tested

the plant, there is first of all the general plant office and the office of the vice-president in charge of operation, and the superintendent. Adjoining this is the drafting room. Beyond this are the washrooms, one for white and one for colored workmen. Then come the electrical shop and the oil storage, and then the general storage room, which is over 100 ft. in length. Beyond this are the blacksmith's shop and the machine shop, and at the end is the laboratory.

This position of the laboratory brings it right in the heart of the plant so that it is near every point from which samples have to be taken. At the left hand is the mill room and, just beyond, the kiln house. In front are the slurry tanks and at the right the pack house.

The chemical laboratory is beautifully equipped. Table and bench tops are of "Alberine" stone, and the storage closets, moist closets and the like are of steel, the sliding doors having ball bearings. This part of the equipment was furnished by the Laboratory Furniture Co. The balances are of the Becker "Chainomatic" type and all heating is electrical.

The physical testing laboratory is in an adjoining room. In addition to the usual physical testing equipment it contains a 200,000-lb. Riehle Bros. testing machine for breaking concrete cylinders. Tests are made for information wanted by the company and also to assist customers who are large consumers of cement. Makers of concrete masonry units sometimes employ this laboratory to check the work of other laboratories.

The design and layout of the laboratory was by R. E. Roscoe, the supervising chemist of the Phoenix company.

Notes of Operation

It is apparent from visiting the plant after it had been in operation for some months that the theories on which it was designed are correct, as the plant does what it was expected to do and has done so from the first.

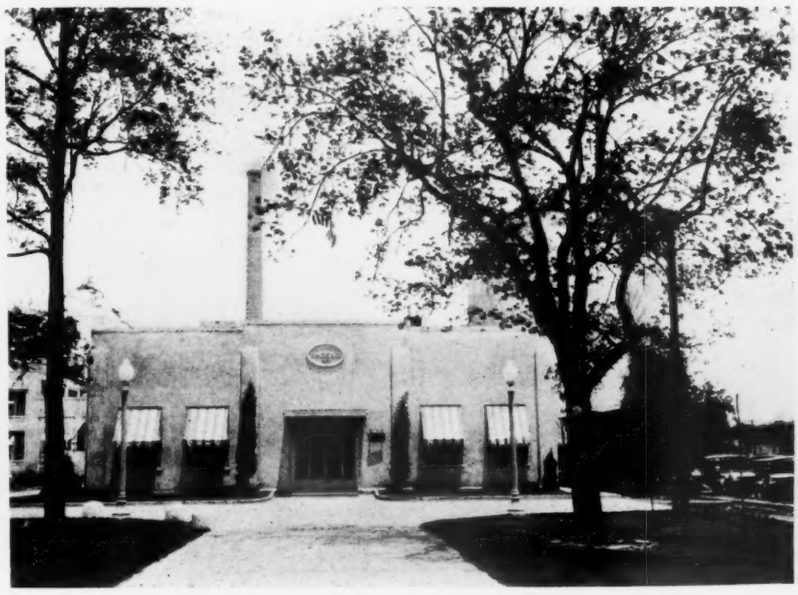
Almost the first question asked by visitors to the plant is, "Does this careful dust collection pay?" The answer depends on the interpretation of the word "pay." It requires about 200 hp. to operate the dust-collecting systems, and the value of the collected dust and coal dust would not pay for this power. However, there is no doubt but that the indirect returns from having a dustless plant pay well. It is apparent to anyone who is familiar with cement plants that it has its effect on the men. As one visitor put it, "There doesn't seem to be anybody in the plant but a few bosses walking around." The absence of dust has also its effect on the life and maintenance of motors and other machines.

Since practically nothing but water and carbon dioxide escapes into the air, the plant is not a bad neighbor. In fact there are many office buildings, pouring out smoke from their heating plants, that are more offensive.

The cement made is of excellent quality, and while it is not a super-portland it has rather unusually quick-hardening properties attaining the hardness in three days that some cements require 7 to 28 days to attain. This high early strength does not come from its chemical composition, because this does not vary remarkably from the average portland cement. It has come in part from the greater attention in the burning in the very long kilns and in part from the grinding, which is finer than specifications require.

The appearance of the plant can better be judged from the pictures than by any description. Everywhere that they are needed are concrete walks, and they are brilliantly lighted at night by street lights on concrete posts of neat design. These were furnished by the Westinghouse company and made at the factory in Winchester, Ind. The appearance of the plant at night is really beautiful.

An 8-ft. flower bed has been planted the full length of most of the buildings. It contains two to three lines of flowering shrubs besides beds of annuals. A strip of lawn is placed between the flower beds and the curbs of the cement walks. The open spaces have been seeded with lawn grass and many trees have been set out in addition to those which



Office end of auxiliary building

were saved when the site was cleared.

The cleanliness and fine appearance of the plant is insured by having a regular force of men who sweep the walks daily, clean windows, apply paint whenever it is needed and look after the lawns and flower beds. This work is considered a regular part of the plant operation and is supervised just as closely as any other part of the work.

Personnel

The business offices of the company are in the Alabama Power building at 600 N. 18th street, Birmingham. The officers and those in charge of various departments are: President, Lindley C. Morton; secretary and treasurer, E. P. Haubert; assistant secretary and treasurer, W. E. Siegfried; sales manager, S. C. McCurdy, vice-president in charge of operation, R. J. Hawn; superintendent, H. O. Underhill; supervising chemist, R. E. Roscoe; master mechanic, G. D. Youell; quarry foreman, H. Hunter; electrician, F. D. Floyd. C. E. Phillips is in direct charge of operation in the daytime and J. L. Ford at night.

The company operates a plant in Nazareth, Penn., and formerly operated a plant at North Birmingham which it sold to the International Cement Corp. Practically all of the men in the list just given are old employes, and some of them have been with the company for 20 years.

Safety provisions have been made in all parts of the plant where men are liable to come in contact with moving machinery or exposed to other dangers. Safety signs are placed everywhere that men pass to remind them of the necessity of being careful.

The Visual Analysis of Sand

By Herbert C. McKay

Director, New York Institute of Photography, Author of Numerous Texts Upon Photography, Eustis, Fla.

BUSINESS cannot be built upon the assumption that "Sand is Sand!" Customers demand to know the analysis of your product, but even so, just what does this analysis mean? The contractor learns that the bulk of the sand will pass through grading screens of a certain size and that the concrete made from this sand will have certain strength. True, this knowledge is all that he may need, but still it leaves him working with mere arbitrary standards. Seldom indeed do the producer and consumer have any real familiarity with the sand. As a result of this lack of familiarity, both producer and consumer depend upon the analysis for their knowledge of the product.

To a certain extent sand is sand, while the precise chemical structure will vary widely; sand is after all of some stable chemical compound including a silicate, and this chemical structure does not undergo any change during the production of concrete, so it appears that the value of sand for concrete, or for any other similar work, depends upon the size of the grain, its shape and angularity. These are all physical attributes, and if the sand grain were considerably enlarged all of these characteristics would be instantly apparent.

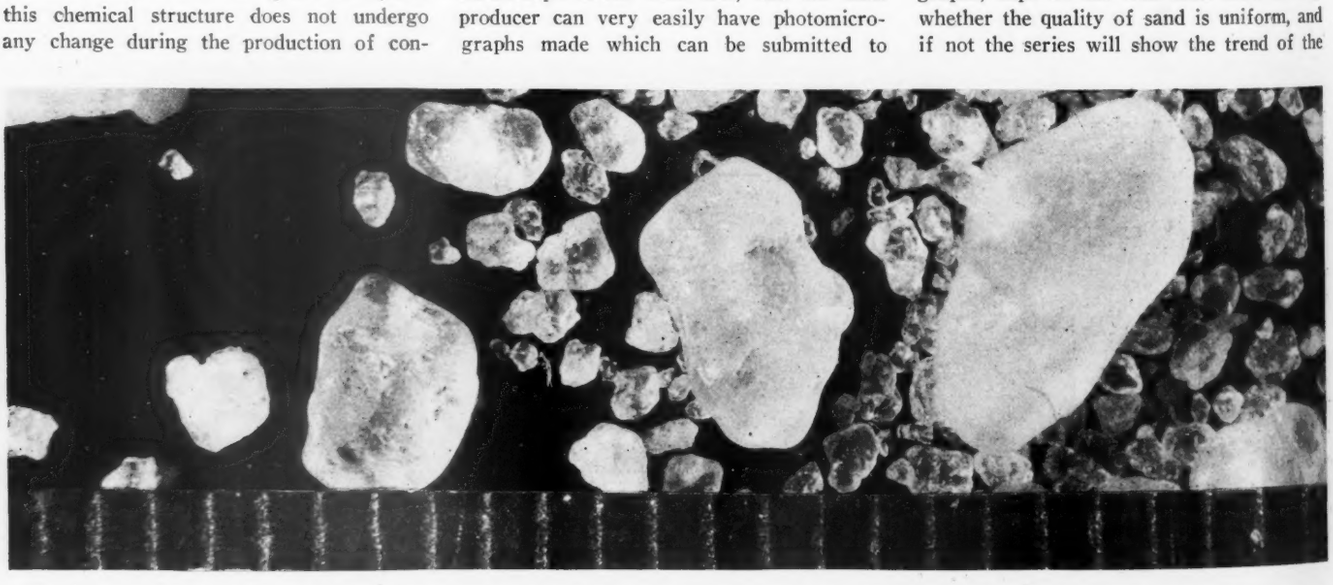
Use a Microscope

The microscope can easily replace the distant laboratory in sand analysis, except for periodical check analyses.

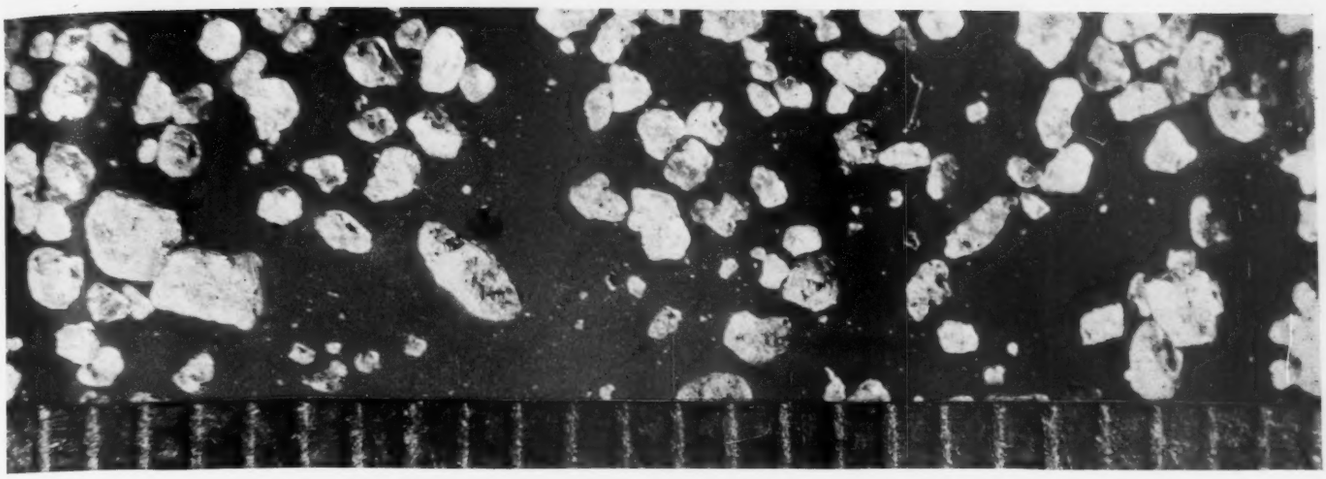
Naturally, before this can actually take place, the interested individuals must learn to interpret the appearance of the sand. It happens that a compound microscope is a fairly intricate instrument, it is somewhat bulky and it is too delicate to subject to the abuse which, for example, the engineer's level gets. The contractor cannot carry a microscope about with him, but the sand producer can very easily have photomicrographs made which can be submitted to contractors. These photomicrographs are of just as good quality as any other photograph, but they show the sand greatly enlarged.

If every sand producer were to establish the practice of using photomicrographs of his product, made to some pre-determined standard scale, contractors would soon learn to recognize sand value from these photographs. For all practical purposes these photographs would replace the weekly or daily analysis. The consumer would no longer depend upon the somewhat abstract information of the analysis report, but would be dealing with tangible characteristics which he could personally recognize, just as he recognizes for himself, the physical characteristics of other materials with which he works.

Moreover, a series of such photomicrographs, kept on file will soon show clearly whether the quality of sand is uniform, and if not the series will show the trend of the



Photomicrograph of the usual run of washed sand. This is a section of a typical record print used to replace the more conventional analysis in certain cases. The scale on the bottom is a standard scale divided into 1/64th of an inch



Photomicrograph of screened sand for finer finishing work

change as clearly as a graph would show it. In short, the photograph shows at a glance that information which if compiled from laboratory reports would require a length period, perhaps several hours, and even then the photographic record is visual, vivid, tangible, while the compilation from the reports is after all but a mass of figures which carry little conviction except to those who are mathematically inclined. We run up against that classic quotation which should hang in the office of every business executive.

"One Picture is Worth a Thousand Words!"

Photomicrographs for Record Purposes

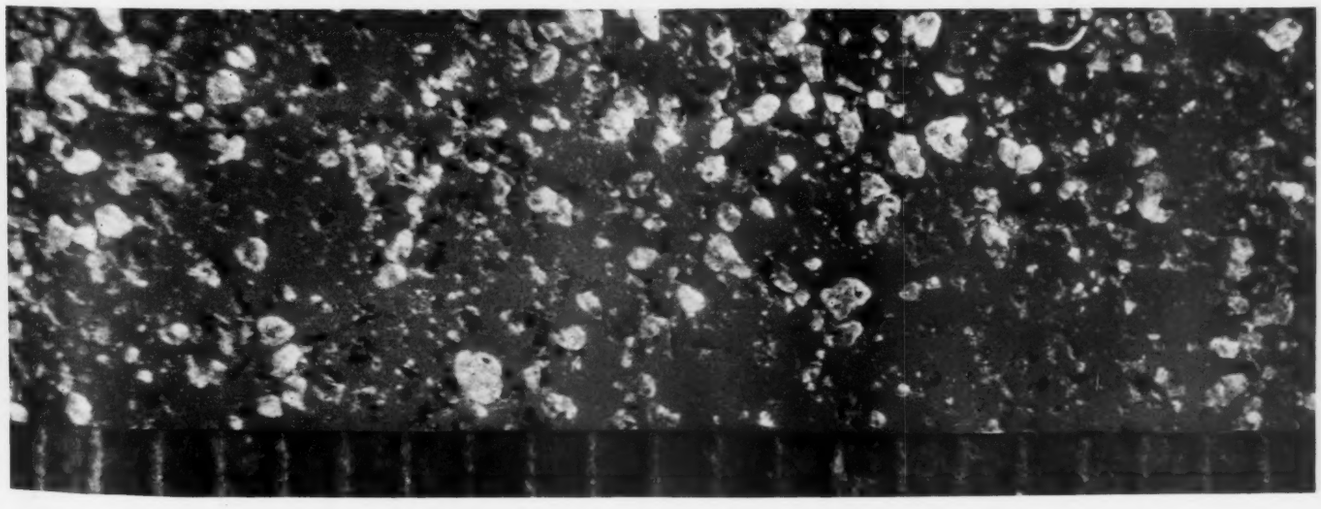
The process is quite practical. Any competent photomicrographer can turn out such records in any desired number, and can, if desired have the laboratory report imprinted upon the backs of the photographs. As to the details, the record photographs can be printed upon 4x6-in. sheets which will fit the usual 4x6-in. filing drawer. The actual photograph area would be 4x5-in. leaving a space one inch wide for data at one end of the sheet. Postcards can be printed from the same original negative and used for advertising purposes. In this case the back of the card would be divided and the advertising message carried upon the left half as in the usual souvenir postcard. For the use of the "big" contractor, 8x10-in. prints may be secured while for hanging up the office wall, in the case of unusually fine specimens, enlargements up to 16x20-in. may be easily made.

Cost of Photographs

The charges made would depend upon the photomicrographer. As this is a highly specialized branch of photography the charges would be somewhat higher than for straight photographs, but the charge for making the negative would probably be only from $2.50 to $3. This includes not only the photographic work, but the filing and care of the negative by the photomicrographer. After this charge, the cost of prints would possibly be 10 cents each for postcards, 15 cents each for 4x6-in. prints for filing, masked for this purpose, $1 each for 8x10-in., and about $3 to $5 each for 16x20-in. enlargements. Prices may run more or less than this average schedule, but it is a fair average. Cheap work is not dependable, for the whole value of this work depends upon careful workmanship in producing the negative.

Briefly, the process is this. The sample is thoroughly mixed and then dusted upon the specially prepared slide. This is placed under the microscope and properly arranged. Then the scale is placed in position, for it is vital that the actual scale be shown in the photograph. Then the lighting must be carefully arranged to secure the best photographic results. After this the camera is placed in position, focused and finally the exposure is made. The negative is developed in a special bath and when dry the scale identification is etched in, the serial number etched in, and the record made out and filed. Only then can the prints be made, so it will be seen that the process is far more expensive to the photographer than is usual work, but after all, the cost is negligible when compared with analyses and when the better results are taken into consideration.

There are several competent photomicrographers in this country who can do this work. The writer has done a considerable amount of this work for local concerns, and the results have been attended with the utmost satisfaction.



Photomicrograph of ordinary surface sand which is not practical for use in concrete

Rock Products Industry in South Dakota

Part III. Sand, Gravel and Crushed Stone

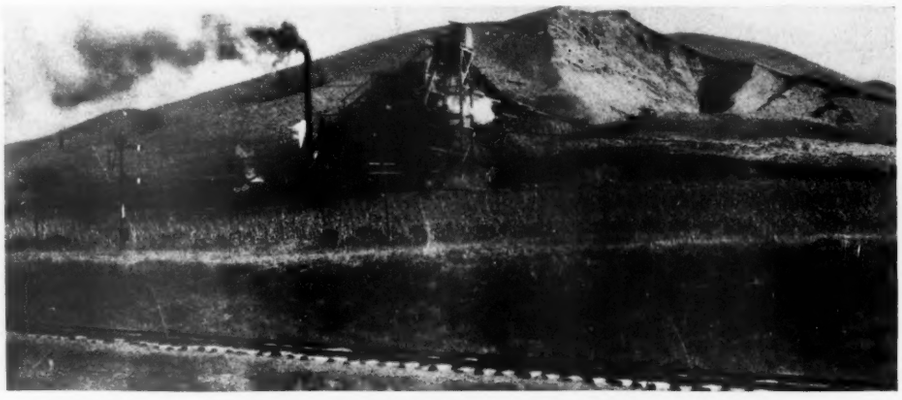
By Francis Church Lincoln
Professor of Mining, South Dakota State School of Mines, Rapid City, S. D.

THIS is the third and concluding article of a series of three, the first having been published in the April 30 issue of ROCK PRODUCTS and the second in the May 28 issue.

Sand and Gravel

Sand and gravel deposits are distributed throughout the state of South Dakota. The most important of these occurrences lie to the east of the Missouri river and are of glacial origin. West of the river, the sands and gravels are stream deposits whose contents have been derived by washing from the Black Hills or local sources.[29]

The Mineral Resources Division, formerly of the U. S. Geological Survey and now of the U. S. Bureau of Mines, has published tables giving the annual productions of sand and gravel in South Dakota since 1909. These annual productions show great variations, ranging from under 200,000 tons to more than 1,500,000. Summing up the published figures for the 16 years from 1909 to 1924 inclusive, the total production is found to be 8,327,608 tons valued at $1,962,003. This production includes building sand, paving sand, engine sand, filter sand, and other sands; together with building gravel, paving gravel, and railroad ballast gravel. State Geologist E. P. Rothrock estimated the 1923 production of sand and gravel in South Dakota at 370,000 tons with a value of $370,000; and in his opinion the production for the past three years has not departed materially from these figures.



Pit and washing plant of the Sioux Falls Sand Co. near Sioux Falls

Sand and gravel are produced in South Dakota on the largest scale from the glacial deposits to the east of the Missouri river, and particularly from those of the Big Sioux valley. Four large companies are operating in this valley—the Sioux Falls Sand Co., of Sioux Falls; and the American Sand and Gravel Co., Zeller's Concrete Materials Co., and Kampeska Materials Co., of Watertown.

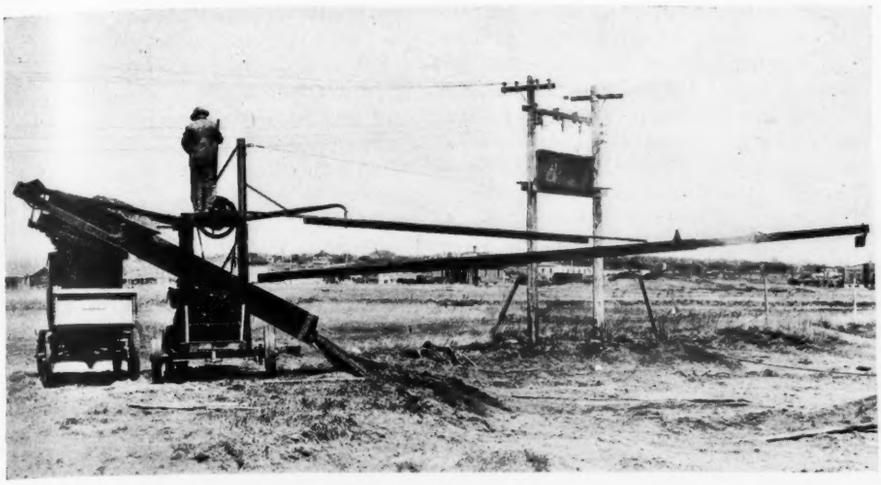
The Sioux Falls Sand Co. has its office at 210 Boyce Greeley building, Sioux Falls, and Delbert Wheeler is its manager. Pit and plant are located four miles from Sioux Falls on a spur from the Chicago, St. Paul, Minneapolis and Omaha R. R. Power is obtained from a 150-hp. marine type steam boiler, which furnishes the steam for four engines — a 65-hp. hoist engine for the scraper, a 35-hp. engine for the pump, a 12-hp. vertical engine for the crusher and a similar engine for the conveyor and screens. Excavation is performed by a 1½-cu. yd. Green power scraper operated by a double-drum hoist, which delivers the material through a hopper to a 22-in. belt conveyor, 350-ft. centers, which carries it to the top of the washing and screening plant.

All material is screened wet. A supply of water of about 400 gal. per minute is obtained with a 5-in. Class E Union Iron Works centrifugal pump from an 8-in. drill hole sunk to a depth of 100 ft., and this quantity is increased by clarifying the used water and reusing the clear portion of it. The screens are revolving conical trommels of the Gilbert type made by the Stephens-Adamson Manufacturing Co. There are two batteries of two screens each; the first screens having round holes 1½ in. in diameter and the second screens round holes ¼ in. in diameter. The batteries are arranged side by side and the oversize from the 1½-in. screens goes to a 9x15-in. Blake jaw crusher. The undersize passes to the second screens, which produce pebbles as oversize, and pass their undersize to the automatic sand tanks. There are three of these, two Telsmiths, used in preparing concrete sand, and one Stephens-Adamson, used for filterbed, plaster, and locomotive sands.

The products made are screened pebbles (¼-1½ in.), with which are included the crushed boulders; concrete sand (from ¼ in. down) which shows a test strength about 125% of Ottawa standard; locomotive sand and plaster sand (from ⅛ in. down); and filterbed sand, which has a uniformity coefficient of 1.9 and an effective size of 0.43

[29]Rothrock, E. P., "Sands and Gravels," Circ. 16, S. D. Geol. and Nat. Hist. Survey (April, 1924), 23-6. For further geological details see Todd, J. E., Bulls. 144 and 158, U. S. Geol. Sur.; and Rothrock, E. P., Circs. 15, 21 and 26, S. D. Geol. and Nat. Hist. Survey.

Oral plant of the Reitz and Crites Sand Co.



One of the three small excavators working at a deposit operated by Zeller's Concrete Materials Co.

mm. The concrete pebbles bring $1.50 a ton; concrete, plaster, and locomotive sands, $0.50 a ton; and filterbed sand, $0.80 a ton. Six men are ordinarily employed working on 9-hour shifts; while for productions exceeding 8 carloads a day, 7 men are necessary. Some 31,000 tons were produced in 1925 and about 33,000 tons in 1926. Shipments have been made outside South Dakota to St. James, Mankato, Worthington and Adrian, Mich., and to Sibley, Sioux City and Hawarden, Iowa.

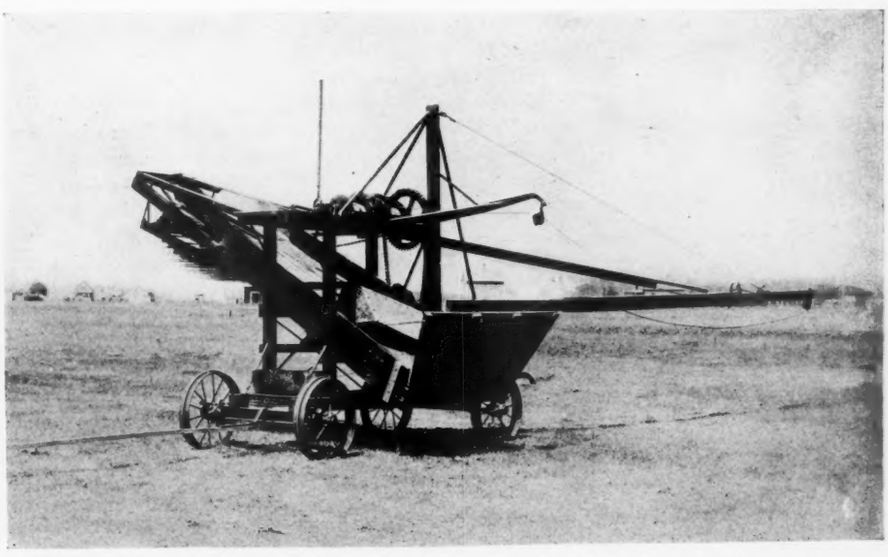
The American Sand and Gravel Co. has its general office at Aberdeen. Mr. J. E. Freeland is manager at Watertown. The company owns two gravel washing plants, one located at its No. 1 or Kampeska spur pit on the edge of Lake Kampeska, and the other at its No. 2, or Yahota pit, 2 miles west on higher ground. No. 1 pit contains about 155 acres, with its south boundary the lake shore. The material has a depth of about 16 ft. and contains some 28% gravel and 72% sand when separated on a ¼-in. screen. There is little gravel over 2 in. in diameter. Excavation is performed with a 10-in. hydraulic dredge pump manufactured by the American Manganese Steel Co., housed and mounted upon a steel boat 26 ft. wide by 40 ft. long, constructed of three 8x40x5-ft. steel pontoons. A 150-hp. 440-v. General Electric motor operates the pump. The excavated material is pumped upon an apron 40 ft. high, where it is spread out and passes over six gravity screens, separation of the rejected material being completed in two revolving screens. A small screen is employed to separate the oversize. This plant will load an average of 180 tons of washed pit run per hour, and from 25 to 28 cars, or 1200 tons of screened material in 10 hours. Tests show less than 1% foreign matter in this material after loading. At No. 2 pit, a dragline, bucket elevator and dump-car system operated by steam power is in use. The material consists of about 40% gravel and 60% sand, and state tests show about 2% of clay in the sand after washing. Both plants are located on spurs from the Minneapolis and St. Louis R. R.

Zeller's Concrete Materials Co. operates two sand and gravel pits in West Watertown and an unloading plant at Huron, S. D., besides making some cement building tile. William Zeller is manager at Watertown. Each pit contains a deposit consisting of about 75% sand and 25% gravel in a bed some 35 ft. thick overlain by 2 ft. of stripping. The company owns three small excavators of its own make, having a capacity of ¼ cu. yd. each, and making about three trips per minute. These machines are employed for both stripping and loading trucks. The company has a wet screen plant at its old pit, and a dredge at its new pit. Sand brings $0.60 a ton and gravel $1.50. The gross income of the company during 1926 was approximately $15,000.

The old pit is located on the Chicago & Northwestern R. R. and contains coarser gravel than the new pit—about 10% being over 1 in. in diameter. A 2-cu. yd. bottomless drag scraper made by the sand company is used to excavate the material, but only reaches a depth of 15 ft. when large stones prevent deeper mining. The excavated material is raised by elevator to a washer and revolving screen mounted on the same shaft. The washer is 3 ft. long, equipped with paddles on the inside, and delivers the material to the inside screen of a set of three concentric screens 6 ft. in length. The inside screen is 20 in. in diameter with 1-in. openings, the middle screen is 28 in. in diameter with ¼-in. openings, and the outside screen is 36 in. in diameter with ⅛-in. openings. Oversize from the inner screen is crushed to 1-in. maximum diameter by an 8x12-in. Universal crusher, and raised on the same elevator used for the original feed to the screening mechanism. The sand is dewatered by means of a drag classifier made by the company which consists of paddles fastened 1 ft. apart on a chain, which drag the wet sand up an incline. Scraper and crusher are driven by a 40-hp. motor; while screen, dewaterer, elevator, pump, and 20-ft. feeder belt are actuated by a 20-hp. motor. Three 100-ton bins are provided for sand and two for gravel. These bins load cars from the side and trucks from the bottom. The South Dakota Concrete Products Co.'s plant is located at this pit, and Zeller's Concrete Material Co. supplies it with gravel and sand for making concrete pipe.

The new pit, acquired in 1926, is located on the Big Sioux river on the line of the Minneapolis & St. Louis R. R. It is 22½ acres in extent and contains less coarse gravel than the old pit, all its gravel being under 1½ in. in size. A 1-cu. yd. Bay City excavator is employed for loading cars at this pit, and one of the company's own excavators for loading trucks. There is no washing plant at this pit at present, but the company contemplates installing one this season.

The Kampeska Materials Co. owns sand and gravel pits on Lake Kampeska and at Watertown; quarries for crushed stone,

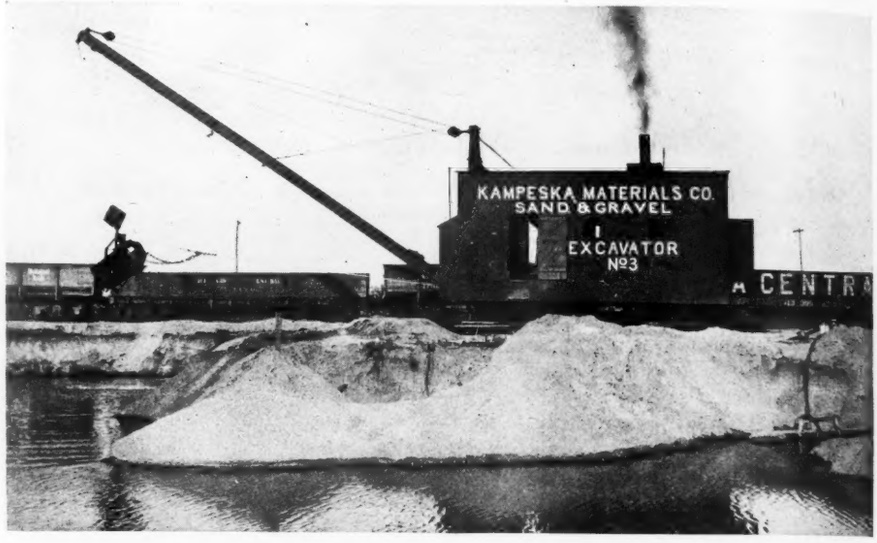


The 1/4-yd. excavator designed and built by the Zeller's Concrete Materials Co. It is used for both stripping and loading trucks

building stone, and paving blocks at Sioux Falls and West Sioux Falls; and also harvests ice from Lake Kampeska. Its present principal operation is at Kampeska Spur near the shore of Lake Kampeska four miles northwest of Watertown on the Minneapolis & St. Louis R. R. There the company has some two miles of sidetracks and operates by steam power a Monighan dragline excavator with 60-ft. boom and 2-cu. yd. bucket, a Channon dragline excavator with 40-ft. boom and 1-cu. yd. bucket, and a Byers clam-shell excavator with 30-ft. boom and ½-cu. yd. bucket. An 8-in. Swaby dredging pump is also in use at this pit and is operated by a main motor of 100 hp. and a control motor of 25 hp. The two dragline excavators are employed in loading washed pit run, the clam-shell machine is used for loading sand from spoil piles, and the dredge in connection with screening operations. No crushing is necessary. The materials are all loaded directly into railroad cars. The gross value of the Kampeska Materials Co.'s output for 1926 was $37,691.82.

While the sand and gravel deposits to the west of the Missouri river are of minor importance when compared with those to the east of it, there are several commercial producers in western South Dakota, among whom is the Reitz & Crites Sand Co., which operates a pit at Oral. The home office of this company is in Chadron, Neb. Its Oral pit is located on the top of a high ridge just outside the town limits of Oral and to the east of the Chicago and Northwestern R. R. tracks. The sand and gravel in this deposit is composed of many different rocks and minerals, including granites, sandstones, quartz, schists, and limestones, and contains such a large percentage of stones as to necessitate crushing. After the oversize has been reduced to 1 in. and under by crushing, 60% of the material will remain on a 10-mesh screen; and the sand is much sharper than that taken from river beds. The Reitz & Crites Sand Co. began operations in 1919, when 200 carloads were shipped, since which time its shipments have averaged 500 carloads a year, exceeding 600 carloads in 1926.

A Hyster double-drum hoist mounted on a Fordson tractor is used to strip overburden and stockpile material. The sand and gravel are excavated by a dragline scraper which has a capacity of 45 cu. yd. per hour and delivers the excavated material through a hopper to an 18-in. belt conveyor, 250-ft. centers. This conveyor carries the sand and gravel to a 3x9-ft. revolving grizzly which removes all the material less than 1 in. in diameter and drops the oversize into a No. 3 Gates gyratory crusher set to crush 1 in. Both conveyor and grizzly are driven by belt from a Fordson tractor, while an Avery caterpillar tractor which develops 50 hp. supplies power through a belt to the crusher. Grizzly undersize and crushed stones come together upon a second belt conveyor which carries them to the top of the washing plant 45 ft. above the loading track. Some 300 gal. of water per minute is pumped from the Cheyenne river through a 4-in. line approximately 4000 ft. in length by a Platt triplex pump actuated by a 4-cylinder Climax gas engine which develops 52 hp. Screening is performed by two 63x31½x84-in. rotary screens of the Link-Belt Dull (conical) type making 20 r.p.m. The first screen takes out the gravel from 1 in. down to ½ in. and the second screen all but the fine sand. The sand is dewatered in a 60x72-in. conical sand separator. A Fordson tractor furnishes the power for the washing plant, the belt conveyor from crusher to washer, and a small generator for lighting at night.



Dragline excavator loading washed pit-run material at the Kampeska Materials Co. plant on Lake Kampeska

The Chicago, Burlington & Quincy R. R. obtains sand for ballast from a deposit near Lead in the Black Hills which has a rather unusual origin. The Wasp No. 2 mill which was wrecked in 1918 had stacked its tailings on the hill beside the Burlington tracks to a height of 150 to 200 ft., holding them in place with piles of brush. After the abandonment of the mill this tailings sand began to wash down on the tracks, and at one time after a small cloudburst the tracks were found to be covered with the material to a depth of 10 to 12 ft. and for a length of several thousand feet. Negotiations between the railroad and the mining company resulted in an agreement under which the railroad company has been excavating the tailings with a railroad steam shovel and using them for ballast during the past four or five years. Some 1000 cars of this material were loaded prior to 1926 and used mainly on the line north of Edgemont. Shipments out of the Black Hills began in 1924, and in 1926 about 700 cars, of 50 tons or 40 cu. yd. average load, were used by the Burlington, mainly on its Alliance division, the tailings sand being hauled as far east as the neighborhood of Hemingford, Neb., 175 to 200 miles.[30]

The South Dakota Highway Commission makes use of considerable gravel in the construction and maintenance of federal aid and state aid highways; while smaller amounts are used by the counties, cities and towns of South Dakota on local roads. During the year ending June 30, 1926, the South Dakota Highway Commission awarded contracts for gravel surfacing federal aid projects calling for 303,100 cu. yd. of gravel at an average cost for loading, screening, the first half-mile haul, and spreading, of $0.325 per cu. yd.; and for gravel surfacing state aid projects calling for 121,221 cu. yd. at an average cost of $0.209 per cu. yd. The total quantity of gravel used by the commission in new work was therefore approximately 318,000 short tons, which was nearly as much as the total amount of sand and gravel mined in the state by private enterprise during the same period. To this great production must be added something like an equal amount of gravel ued by the commission in resurfacing and stockpiling old construction over a length of 1,010.73 miles.[31]

All gravel surfacing of new construction work under the management of the South Dakota Highway Commission is done by contract. Prospecting for gravel deposits is conducted by the resident engineer while embankment is under construction, and so widespread are these deposits that long hauls are seldom necessary. The deposits discovered are tested both for quantity and for quality. Test holes are sunk by hand in every 100-ft. square. They are made about 4x6 ft. in cross sections and carried to the bottom of the deposit, unless it exceeds the maximum depth of 12 ft. Deeper holes cannot conveniently or economically be sunk by hand labor. The quality of the gravel from all promising prospects is tested in the Mate-

[30] Letter from Mr. J. L. Bentley, Div. Freight and Passenger Agt., Deadwood.

[31] "Annual Report of the South Dakota Highway Commission for the Period Ending June 30, 1926, to the Governor."

rial Testing Laboratory of the commission at Pierre.[32]

The contractors working for the Highway Commission commonly excavate the gravel with Fresno scrapers. These haul the material to a trap through which it drops to a belt conveyor which carries it to a screening plant consisting of a revolving screen and a loading hopper holding from 10 to 25 cu. yd. From 4 to 6 scrapers are required to keep the plant busy, and the production is from 700 to 1000 cu. yd. per 10-hour day. Special equipment has been used in a number of instances. Between Spearfish and Belle Fourche a dragline excavator was employed and the coarse gravel crushed by two gyratory crushers, a No. 4 and a No. 2. This plant had a capacity of about 400 yd. per 10-hour day. A unit crushing plant made by the Iowa Manufacturing Co. was operated between Beulah and Spearfish. Between Piedmont and Black Hawk, gravel for highway use was excavated with a steam shovel.

Maintenance of old construction is carried on in part by the commission itself. A gravel crew is employed on resurfacing and stockpiling work, equipped with an outfit consisting of a portable loading and crushing plant and a fleet of approximately 40 trucks. During the year ending June 30, 1925, the state gravel crew resurfaced 288.7 miles of gravel roads, which included the loading and hauling of 119,547.3 cu. yd. of gravel. The cost of this gravel per cubic yard, including loading, stripping and crushing when necessary, was $0.364.[33]

Stone

The most important commercial stone in South Dakota is the Sioux quartzite, formerly known as the "Sioux Falls granite" or "jasper." It is pre-Cambrian in age and outcrops in the southeastern corner of the state. An extensive exposure occurs in the neighborhood of Sioux Falls and extends up the Big Sioux river to beyond Dell Rapids, connecting to the eastward with a similar outcrop in Minnesota. Going westward from the Big Sioux river to Mitchell, prominent exposures are developed in all the deeper stream valleys.[34] This rock has a thickness exceeding 1000 ft. at Sioux Falls, thinning out to the westward to a thickness of 400 ft. in the vicinity of Mitchell.

The Sioux quartzite is composed of grains of quartz sand held together by siliceous cement. It is commonly fine-grained and pink in color, although sometimes gray or purple. The analyses in Table VIII indicate its great purity.

TABLE VIII—ANALYSES OF SIOUX QUARTZITE

	No. 1 East Sioux Falls[35]	No. 2 Dell Rapids[36]
SiO_2	98.85%	99.14%
Al_2O_3	1.02	0.28
Fe_2O_3		0.50
CaO	Trace	Trace
MgO	Trace	Trace
Loss at 105 deg. C.	0.01	.....
Loss on ignition	0.23	.....
	100.10%	99.92%

It is a very hard, strong and durable stone; absorbing only minute amounts of water, highly resistant to acids, and fusing only at a temperature of about 3300 deg. C. Its tensile strength exceeds 50,000 lb. per sq. in. and its French coefficient of wear ranges from 14 to 28 in different quarries.[37]

The Sioux quartzite was formerly largely quarried for use as building stone, paving blocks, tube-mill linings and grinding pebbles, but the demand for these purposes having declined, it has found a number of new uses and is now mined on a large scale for use as concrete aggregate, as stucco aggregate or "pebble dash," in filter beds of sewage disposal plants, and as a refractory furnace lining in steel mills. Six large quarries were active in 1925, according to the report of the State Mine Inspector—the Dakota Granite Co., the Wisconsin Granite Co., and the W. V. Lowe Granite Co. at Sioux Falls; the Simpson Stone Co. and the Superior Construction Co. at Dell Rapids; and the Spencer Quarry Co. at Spencer. Readers of Rock Products have already become familiar with the operations of the Wisconsin Granite Co. at Sioux Falls and of its subsidiary, the Superior Construction Co. at Dell Rapids, through the interesting detailed description which appeared in May 15, 1926, issue. The Wisconsin Granite Co. produced 48,657 tons of crushed stone valued at $53,522 in 1925; and the Superior Construction Co., 42,815 tons valued at $58,560.

The Simpson Stone Co. is more briefly described in the article to which allusion has just been made, and a few additional details may prove of interest. This company produced 13,569 tons of crushed stone valued at $18,996 in 1925, together with $180 worth of paving blocks; while in 1926 it worked at only about one-third capacity on account of money shortage in its trade territory. The quarry has been in operation for 30

[32]Notes on graveling operations of the Commission kindly furnished by Mr. Eugene Meeker.

[33]Annual Report of the State Highway Commission to the Governor for the Period Ending June 30, 1925.

[34]Darton, N. H., "Geology and Underground Waters of S. D.," W. S. Paper 227, U. S. Geol. Survey (1909), 32-40.

[35]E. I. du Pont de Nemours Co., Du Pont Magazine, May, 1926.

[36]How Quartzite Producers Found and Developed New Markets," "Rock Products," May 15, 1926.

[37]U. S. Dept. of Agriculture, Bull. 1132 (1923), p. 32.

Quartzite quarry and crushing plant of the Superior Construction Co., Dell Rapids, S. D.

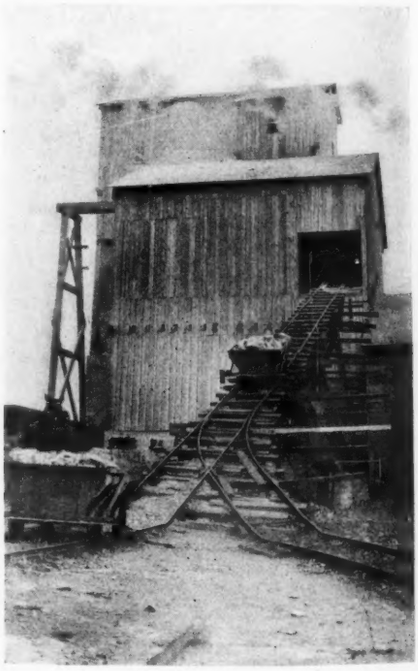
years and the crushing and screening plant was erected in 1911. Frank A. Briley is manager. Quarry and plant are located 1½ miles east of Dell Rapids on a side track from the Chicago, Milwaukee & St. Paul R. R. The quarry face is carried 30 ft. in height. Holes are drilled to a depth of 33 ft. with a Sparta well drill using a 5-in. bit. They are placed about 15 ft. to 18 ft. back from the face and spaced about the same distance apart, depending upon the strength of the face. The holes are loaded with from 150 lb. to 200 lb.—exceptionally 500 lb.—of 60% dynamite, and tamped to within 2 or 3 ft. of the top with sand. Electric firing by battery is employed, two caps being used to each hole, and from 2 to 16 holes shot at one time. When quarrying building stone to meet occasional demands, holes are charged with 50 lb. of dynamite at the bottom, followed with from 8 to 15 kegs of black powder, are tamped with sand, and are fired in pairs. Broken stone is loaded into 2½-ton quarry cars by hand at a piecework cost of 40 cents a car and hauled to the crusher by horses. The rock is crushed in an Allis-Chalmers No. 6K Gates crusher and elevated to an Allis-Chalmers revolving screen 16 ft. long by 40 in. in diameter, making sizes from ¼ in. to 4 in. as desired, and returning any oversize to the crusher. There is always a 4-ft. sand screen with ¼-in. openings at the head of the revolving screen making dust, which sells locally for use in cement work and plastering. The ¼-in. size is used in pebble dash and is shipped as far as to Chicago and New York; while the larger sizes are employed in concrete and in filter beds and are shipped to Iowa, Nebraska, Kansas and Minnesota.

Limestone quarry of the Northwestern Quarry Co. near Rapid City

The Dakota Granite Co. at Sioux Falls produced 24,000 tons of crushed stone valued at $43,175 in 1924, and was a producer in 1925. Most of this stone was used for stucco aggregate, and shipments have been made to New York, California and Canadian points. The methods of excavating and preparing the quartzite are similar to those employed at the quarries of the Wisconsin Granite Co.[38] The W. V. Lowe Granite Co., successor to Lowe & Handley, has operated on a large scale for many years at East Sioux Falls and Rowena.[39] Four separate quarries were formerly worked by this company in East Sioux Falls, but production has declined in recent years; the concrete aggregate and paving blocks produced in 1925 having been valued at only $2,179; while in 1926, the lack of demand for building stone and paving blocks and the difficulty of securing cheap skilled labor, led to the closing down of the quarries. To the west of the Big Sioux river exposure of Sioux quartzite, the only quarry operating on this rock in 1925 was that of the Spencer Quarry Co. on the Wolf Creek exposure at Spencer, although in the preceding year there were two small quarries in operation on the Pierre Creek exposure at Alexandria.

The Spencer Quarry Co. owns 160 acres of stone land and is under the management of W. A. Barnhart. Its quarry face is some 800 ft. in length and is carried as a single face 18 ft. high. Drilling has been performed in the past with an Armstrong blast-hole drill and the holes sprung with 60% dynamite, loaded with from 5 to 7 kegs of black powder, and fired by electric battery. Too much secondary blasting is necessary when this method is pursued, and it is now proposed to use an air drill and space the holes more closely. A 4-in. centrifugal pump is employed to remove rainwater from the pit. An Allis-Chalmers crushing and screening plant with a rated capacity of 500 tons per 10 hours is in use, but owing to the extreme toughness of the rock its actual production averages 300 tons in 10 hours. The Sioux quartzite is everywhere a hard and strong rock, but at Spencer its toughness is unusual, a French coefficient of wear of 28 having been obtained on the Spencer rock at Lewis Institute, whereas coefficients of 17 to 19 are the rule in the quarries farther east. The plant is at present operated by steam, but will probably change to electrical operation this season. The machinery installed includes a No. 6K Gates gyratory crusher, a No. 5D Gates gyratory crusher, a No. 6 Style B Gates elevator with 64-ft. centers, a 40-in. by 20-ft. Gates closed and revolving screen, and a 24x24-in. friction hoist. The crushed stone is used for concrete aggregate, filter beds and stucco aggregate; and the 10% of fines produced in crushing makes an excellent concrete sand. Some building stone is also quarried. The production of concrete aggregate and sand amounted to 2113 tons valued at $2072. The company did not operate in 1926, owing to poor market conditions, but plans to work on an enlarged scale this year.

Pre-Cambrian granite of a beautiful mahogany color, and of monumental quality, outcrops to the south of Big Stone Lake between Milbank, S. D., and Ortonville, Minn. This granite was quarried in 1925 by the Milbank Mahogany Granite Works and the Whetstone Granite Co., both of Milbank. Several new quarries have been opened in the district recently, the Dakota Granite Works of Milbank, and Johnson & Lindholm and the Columbia Granite Works, both of Ortonville. The Robert Hunter Granite Co., which has succeeded the Milbank Mahogany Granite Works, is the largest producer, its annual shipments averaging in excess of $150,000. Details of its



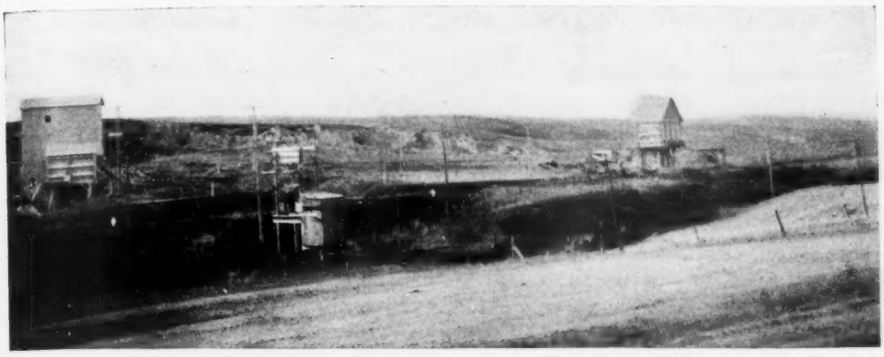
Incline to crushing plant of the Spencer Quarry Co., Spencer, S. D.

[38] Moulton, G. F., "Stone," Circ. 16, S. D. Geol. and Nat. Hist. Survey, April, 1924, pp. 27-8.

[39] Todd, J. E., "Mineral Resources of South Dakota," Bull. 3, S. D. Geol. Sur., 1902, p. 87.

operations are omitted as being outside the scope of ROCK PRODUCTS.

Limestone is the chief commercial stone of the Black Hills at the present time, although formerly much sandstone was quarried there for use as building stone. The two most important limestones in the Hills, the Pahasapa of Mississippian Age and the Minnekahta of Triassic Age, are used for making lime and the quarries and kilns employing them have already been described in the section on "Lime"; while the Minnekahta limestone is used in the manufacture of cement, and its analysis and a description of the limestone quarry at the state cement plant at Rapid City have been included in the section on "Portland Cement."



Quarry and crushing plants of the Northwestern Quarry Co.

The Northwestern Quarry Co. is quarrying Minnekahta limestone for commercial crushed stone. A. C. Hunt of Rapid City is manager. The quarry is about four miles northwesterly from Rapid City just west of the tracks of the Chicago and Northwestern R. R. All holes are drilled downward with dry sinker air drills, which are supplied with air at 50 lb. pressure by a duplex double-acting upright Gardner compressor operated by a 20-hp. electric motor. Holes are drilled 16 ft. to 18 ft. deep, set about the same distance back from the face, and spaced a little further apart. The holes are chambered with 40% dynamite in ⅞-in. sticks. From 6 to 12 sticks of dynamite are used for the first chambering shot, tamped with four double-handfuls of fines, and fired with fuse and primer; while the second chambering shot is composed of from 30 to 45 sticks, the hole being half filled with fines, and the shot fired by electric cap. The hole is next cooled with air and then loaded with from 50 to 100 lb. of black powder, which is fired by electricity, using a No. 6 cap in a stick of dynamite. Quarry cars of 6500 lb. capacity are loaded by hand at the face and run by gravity to the crusher, where they are automatically dumped and then pushed back to the face by hand.

There are two crushing plants on the property. The one in present use is equipped with a No. 4 Gates gyratory crusher, an elevator, and a 40-in. by 12-ft. revolving screen, all operated by electricity. The old plant crushes with a No. 5 Universal jaw crusher. The sizes made are through 1¼ in. on ½ in., through ½ in. on ¼ in., and through ¼ in. The coarse size is the main product and is used as concrete aggregate locally and also shipped to a distance, some having been employed in the Chamberlain and Pierre bridges across the Missouri river. The fine size is used in terrazzo floors, and the screenings as plaster and concrete sand. A cement-mortar briquet test on this sand made by the South Dakota State Highway Commission showed it to have a tensile strength of 394 lb. per sq. in. Besides selling screened products, the Northwestern Quarry Co. also sells considerable crushed rock and riprap to the railroad for use as ballast.

The Dark Canyon Stone Co., with office at 7th and Rapid streets, Rapid City, is under the management of H. W. Jones. It is quarrying Pahasapa limestone at Dark Canyon, 7 miles west of Rapid City on the line of the Rapid City, Black Hills & Western R. R. The Pahasapa at this point is some 300 ft. in thickness and the quarry has been opened in the nearly vertical face of the canyon of Rapid creek. The following analysis of the material was made by the Holly Sugar Corp. at Swink, Colo.:

Silica and Insoluble	2.10%
Iron and Aluminum Oxides	0.36
Calcium Carbonate	67.86
Magnesium Carbonate	29.56
	99.88%

The French coefficient of wear of this magnesian limestone is 8.8 and its toughness 5 as determined by the Western Laboratories at Lincoln, Neb.

The rock is quarried in benches from 6 to 8 ft. in height, the quarry face having a height of about 100 ft. Dry sinker drills are used, the holes loaded with from 3 to 5 sticks of 40% dynamite, and fired with fuse and cap. The broken rock is transported to the tipple of the crushing plant in 1-ton cars trammed by hand. The crusher is a No. 3D Gates gyratory. The crushed rock is elevated to a 36-in. by 12-ft. revolving screen capable of making any desired size from ¼ in. to 2½ in. A 20-hp. gasoline engine supplies the power. The coarse product is used as concrete aggregate, and the fines are manufactured into cement brick at Rapid City, where four Shope brick machines are installed; or it is used as sand for concrete. The magnesia in the limestone renders the bricks somewhat sticky, so that one part of river sand is mixed with three of fines for making them, but this is found to be unnecessary for concrete work. Tests on the concrete bricks made at the South Dakota State School of Mines gave the following results:

COMPRESSIVE TEST
Average of 5½ bricks
P, in pounds per sq. in.

Age	P
30 days	1078
90 days	1630
1 year	2115
4 years	3035

TRANSVERSE TEST
Average of 5 bricks
P, total breaking load, lb.
R, modulus of rupture, lb. per sq. in.

Age	P	R
30 days	608	337
90 days	662	367
1 year	977	548
4 years	1932	1680

Size of bricks: 2⅜x3¾x8 in. Span in transverse test, 7 in. Mix: 1:3:1. Maximum size of crushed stone in mix: ½ in.

The 1½-in. concrete aggregate made by this company weighs 2500 lb. per cu. yd. and sells in large lots at $1.35 per ton at the quarry. The Dark Canyon Stone Co. produced 4316 tons valued at $3668 in 1925 and about the same amount in 1926.

Neither the Minnekahta nor the Pahasapa limestone is sufficiently resistant to abrasion to be employed satisfactorily as a coarse aggregate for use in paving. The Dark Canyon Stone Co. and the Northwestern Quarry Co. have therefore each secured a half interest in the Paving Granite Co., which owns a quartzite quarry at Minnelusa siding, 9 miles west of Rapid City on the line of the Rapid City, Black Hills & Western R. R. There the quarzite is of pre-Cambrian age, is known to the trade as "granite," and has a French coefficient of wear of 19.6, thus strongly resembling the Sioux quartzite of southeastern South Dakota.

Holes are drilled 6 to 8 ft. deep with dry sinker drills, filled two-thirds full of 40% and 60% dynamite, or of 60% dynamite alone, and tamped with sand. Shots are fired with a No. 6 cap and fuse, or electrically. Secondary breaking is performed mainly with 21-lb. sledge hammers, but occasionally by block-holing. The broken rock is loaded by hand and trammed to the crusher bin. The plant is operated by electric power brought 1 mile over a line belonging to the company, and has a capacity of 300 tons per 10-hour day. A No. 5 McCully gyratory breaker crushes the material; and it is screened on an inclined plate of perforated metal with ¼-in. opening; and a 48-in. by12-ft. revolving screen, making sizes from 3-in. to ½-in. as desired. The 2½-in. size weighs 3000 lb. per cu. yd. and brings $2.35 per ton at the quarry. This material has been used for city paving at Rapid City,

Pierre and Hot Springs; while the size through ½ in. on ¼ in. has been employed as top dressing for bitulithic pavements in Chadron, Neb. This quarry has not been in recent operation, since there has been no demand for paving aggregate of late.

The purity of the Pahasapa limestone in the neighborhood of Pringle and its freedom from magnesia have already been commented upon, and the fact that there was at present no lime production from that locality was also noted in the section on "Lime." The pure Pringle limestone is, however, being quarried quite extensively by John Erpelding and F. V. Redenbaugh for use in the refining of sugar. These quarries are near Loring siding on the Chicago, Burlington & Quincy R. R. five miles south of Pringle. Mr. Erpelding has been quarrying sugar limestone for the past 10 years, getting out about 75 tons a day and 5000 tons a year, at a price of $1.35 a ton. The rock is drilled with an air drill and broken with dynamite and black powder. The broken rock is hand sorted, and pieces ranging from 3 or 4 in. in diameter up to 50 lb. in weight are loaded into dump wagons and hauled to the railroad for shipment to the sugar plants. Mr. Radenbaugh has a quarry with a face 75 ft. high and 650 ft. long, located ⅜ mile east of Loring siding. He operates in much the same manner as Mr. Erpelding, drilling with compressed air, springing his holes with 40% dynamite, and blasting with black powder. The broken rock is worked down to a convenient size for handling by means of stone hammers and picks, the smaller material going into the waste dump. He shipped 42 carloads last year and expects to ship from 400 to 600 this year.

No description of the stone industry in the Black Hills would be complete without brief mention, at least, of the building, monumental and decorative stones now quarried in that region. The sandstone quarries were formerly regular and important producers of building stone, but are now only worked intermittently to meet occasional demands. The Dakota sandstones of Upper Cretaceous Age is the most important, although several other sandstones have been quarried for building stone. The Evans quarry in the Dakota sandstone near Hot Springs was first opened nearly 40 years ago and was reopened a little over a year ago by Henry Bering. A very beautiful green granite has been quarried for monumental use from the Green Granite Quarry belonging to S. R. Halley, of Rapid City, and situated 12 miles west of that town. Small amounts of rose quartz are mined annually from veins in the Algonkian rocks in the neighborhood of Custer. This mineral is used as an ornamental and a semi-precious stone, and has been shipped all over the United States and as far as China. The Minnekahta limestone of some localities makes a handsome decorative stone. A carload of this limestone was shipped from South Canyon, near Rapid City, to St. Paul last fall by the Minnekahta Marble Corp., of which D. D. Sheldon of Waterloo, Iowa, is manager. An unusual monumental use of Black Hills stone is now being planned by Gutzon Borglum, the sculptor, who proposes to carve a national monument from the pegmatite of Rushmore Mountain near Keystone.

Rate of Carbonation of Lime Plaster

ONE of the first facts to be recognized concerning the properties of lime is that its combination with the carbon dioxide of the air is the main reaction which leads to the formation of the bonding material of lime mortar and plaster. However, definite facts concerning the recarbonation process have not been available and an investigation has therefore been undertaken at the U. S. Bureau of Standards to obtain more information on this subject. Three different variables have been given special consideration.

(1) *Type of mortar.*—Four different types of lime were used in making up 2-in. cubes; namely, a high-calcium quicklime, a dolomitic quicklime, a high-calcium hydrated lime, and a dolomitic hydrated lime.

Model of proposed national monument to be carved from the pegmatites of Rushmore mountain by Gustav Borglum

(2) *The richness of mortar.*—Mortar containing three different proportions of lime and sand was made from each of the four types of lime mentioned above. The richest mortar contained 1 part of hydrated lime to each part of sand by weight; another, 1 part of hydrated lime to 3 parts of sand; and the leanest mix contained 1 part of hydrated lime to 9 parts of sand.

(3) *The different surface coatings of the mortar.*—A sufficiently large quantity was made up of each of the 12 mixes mentioned above, so that three identical cubes, with surfaces as follows, could be made from each mortar: (*a*) Uncoated, (*b*) ⅛ in. of the usual white finish coat, and (*c*) an oil paint. At the end of definite increments of time ¼-in. layers were removed from each of the cubes and analyzed. The results obtained to date indicate the following:

(1) *Richness of the mortar.*—In the 1:1 mortar there was no appreciable amount of carbon dioxide inside of the second ¼-in. layer after 120 days aging, while at the end of the same length of time a relatively large percentage of carbon dioxide was found in the third layer of the 1:3 mortar, and the 1:9 mortar was quite evenly carbonated throughout.

(2) *Surface coating.*—The cubes which were not coated showed considerable carbonation at the end of 30 days and there appeared to be a fairly steady increase in the carbonation at least up to a certain limit.

The application of a ⅛-in. white coat to the surface of the cubes retarded the rate of carbonation considerably. This effect was more marked in the case of the richer mortars than in the 1:9 mortar. While the white coat of plaster undoubtedly retards the carbonation of the underlying plaster, there was, nevertheless, a steady increase of the carbon dioxide content, so it may be said that this finish coat is not impervious to carbon dioxide and its effect is therefore neither permanent nor serious. The application of an oil paint to the 1:1 mortar reduced its rate of carbonation considerably below that surfaced with a white coat. However, even in this case there was a slight increase noted in carbon dioxide content at the end of each 30 days. The painting of the 1:3 and the 1:9 mortar reduced the carbonation in about the same degree as the application of the white coat, and as these two mixes represent the two extremes which may be found in lime plaster, it is evident that the painting of a sand float finish will not have a serious effect upon the carbonation of the underlying plaster. However, the fact that it is possible to produce a fairly impervious film of paint on a smooth surface, such as a 1:1 mortar, would indicate that the advisability of applying an oil paint to the white coat of lime plaster before the underlying coats have completely carbonated is indeed questionable.—*Technical News Bulletin* of the U. S. Bureau of Standards.

Concrete for Various Purposes

A RECENT publication, bulletin No. 23, of the Kansas City Testing Laboratory, Kansas City, Mo., contains some valuable data on how to prepare a portland cement concrete with desirable properties for special purposes. Several chapters each have been devoted to the necessary admixtures and procedure for waterproofing, freeze-preventing, quick-hardening, improving workability, light weight, insulation, sound-proofing and parasite-proofing of concrete. Some typical formulas, grading charts, strength tests, etc., are included in the report.

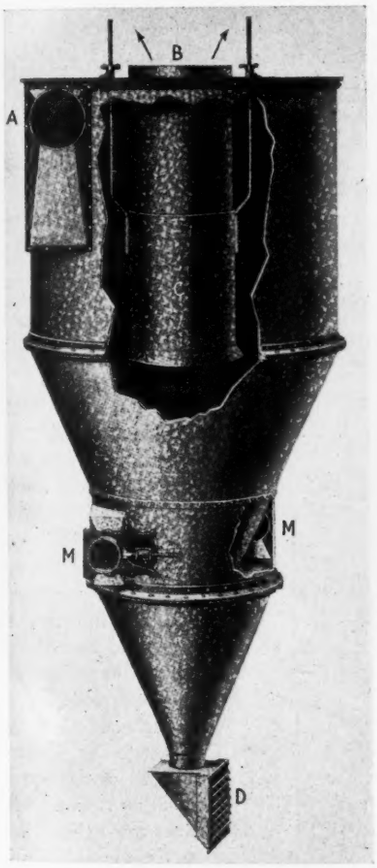
Air Separation Methods Used in Fine Grinding of Rock Products

IV.—Continues Discussion of Separators in Use — Types Employing Fans

By Edmund Shaw
Editor, Rock Products

Other Separators Without Interior Moving Parts

There are several other separators without interior moving parts for, as already explained, any cyclone may be used as a separator within limits. To do the work of a real separator, however, it must be provided with adjustments to adapt it both to the feed (in kind and quantity) and to making the desired product.



The extensible center tube and the "mesh valve" (M) control the size of product

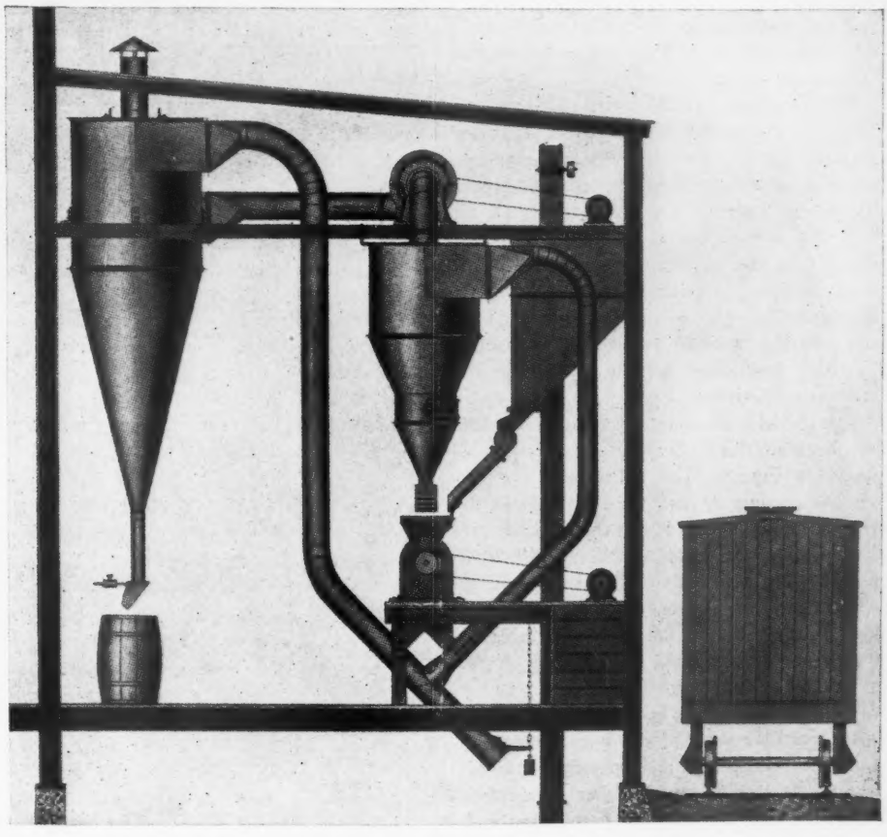
The Federal centrifugal separator is a device which is provided with such adjustments. It employs the cyclonic principle to create the centrifugal motion and varies the length of the interior tube through which the outgoing air rises. This is connected to the suction of a fan. It is obvious that the longer this tube is made the higher the velocity in the restricted area and the coarser the material withdrawn by the air.

A second adjustment is provided in what the makers call the "mesh valve" because it regulates the mesh size of the product. When this valve (which is shown in the cut in the lower part of the device) is closed, practically all the solids carried by the air will be settled. When these valves are opened the downward centrifugal force is lessened proportionately and more of the solids are sent out through the tube in the center. By using the variability of the length of the tube and by opening and closing the mesh valves the product may be regulated as desired, even while the machine is running. This machine operates under partial vacuum, produced by the suction of the fan and the rarefication of the air plays its part in the settling of the fine solids. The vacuum varies with the specific gravity of the material.

Air Separators with Interior Fans—A 1921 Model

The oldest American machine of a fan type is the Emerick separator which has already been mentioned as an improvement over the Pfeiffer and other European machines. While the Emerick separator is no longer made, it is sufficiently interesting from a historical point of view to be worth a description, and its simplicity makes it somewhat easier to understand than some other forms. The figure shown is from a description published in Rock Products, April 9, 1921.

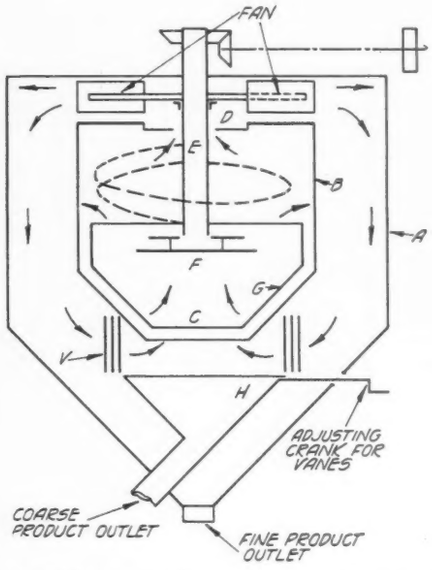
The machine consists of an outer shell A,



Separator without moving parts as employed in grinding various rock products

entirely closed except for the outlet at the bottom from which the fine product is discharged. Within this is an inner shell B with openings at the bottom and at the top, C and D, and within this a third shell G. In the center is a hollow shaft E driven by gears. On the bottom of this is hung the flat revolving plate F.

Feed is put in through the hollow shaft E and falls on the revolving plate F. The



An older type of American air separator with interior fan

motion of the plate throws the feed from the edge of this plate. The heaviest particles fly out to the inner shell G, strike it and roll down the inside of G, and fall into the hopper H, where they go to the coarse (oversize) outlet.

The remainder of the solid particles are lifted by the suction of the flat-bladed fan marked "fan" in the cut. But these grains are also acted upon by centrifugal force, the whole body of air inside the shell B being in motion from moving parts. All the air in the machine is kept in circulation by the fan, rising through the shell B, passing out into A and then going down and entering the shell B through the vanes V. And these vanes may be set by the adjusting crank shown.

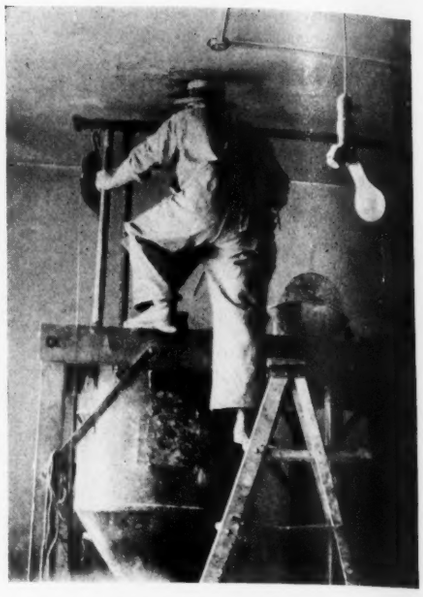
The particles lifted by the fan and whirled by the centrifugal current separate as is shown in Fig. 8. The lighter particles go out the opening D and the heavier (which are more acted upon by the centrifugal force) fly to the inside of the shell B and roll down and into the tailings hopper H. Everything that passes through the opening D and into the fan is thrown against the inside of the shell A and falls down to the fine product discharge.

This separator was fairly successful in a commercial way, but it did not do as good work in some places and on some sorts of material as it did under other conditions. Changes had to be made in proportions and (with some machines) the addition of other parts. Then there were many changes which had to be made in the construction to improve the durability of the machine. Some of these changes will be brought out in the descriptions which follow.

The "Gayco" Separator

The Emerick separator was manufactured and sold in this country by Rubert M. Gay, of New York, who later invented a separator quite different, except in outward appearance, from the Emerick. Mr. Gay came to the conclusion that the centrifugal motion of the particles was the important factor in making a successful separation. He thought this should be both positive and controllable beyond anything found in previous devices, and for this reason he invented the fan above the feed plate that is the distinguishing feature of the Gayco separator.

Mr. Gay says that the idea was suggested to him by a cream separator in his dairy. He conceived centrifugal separation as taking place in a body of air holding dust in suspension and given a positive and uniform rotation. The fan above the feed plate which imparts this rotation is spoken of in the company's literature as "the centrifugal vanes." These are not to be confounded with the deflector vanes used in many types of air separators, which are stationary except for the adjusting motion so as to give a greater or less rotary move-



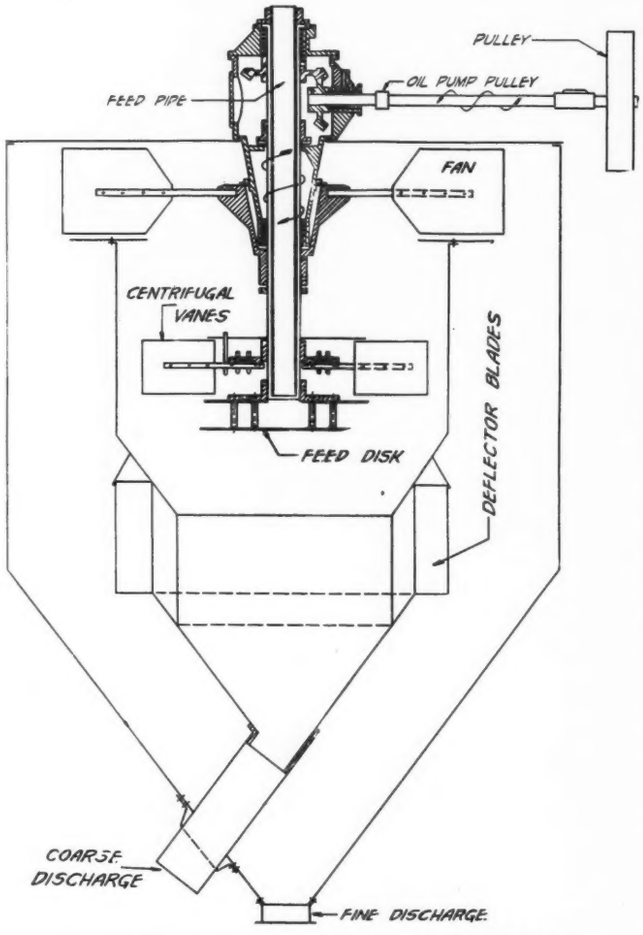
Feeding material by hand to a small air separator used for test purposes

ment to the air forced through them. The Gayco separator has such vanes on the under side of the inner shell but they are not adjustable.

The machine runs at a comparatively slow speed, averaging 160 r.p.m., and requires little power. The largest size, which is 14 ft. in diameter, requires only 12 hp., and the smallest size, which is 30 in. in diameter, requires ¼ hp. The range of the fine product is from 60-mesh to 325-mesh in ordinary work, but it can be set to deliver finer products than 325-mesh. It is not recommended for separations coarser than 60-mesh, but the writer has been informed that somewhat coarser separations have been successfully made by it.

The main adjustment is made by changing the fan above the distributing plate which gives a whirling motion to the air in the inner shell. The blades of this fan may be changed for a larger or smaller size and the angle of the blades may be changed.

The company maintains a laboratory in New York in which it has one of its 4-ft. separators installed with the usual screens, balances and the like for



Improved type of air separator with interior fans

making screen analyses of the products. The writer spent an afternoon in this laboratory and saw the separations made and the adjustments changed so as to vary the product. The changing of the fan blades, which had appeared to be something of a job, required only the opening of doors in the shells and

Small scale air separator in test laboratory maintained by one of the companies

working for a few moments with a wrench and screwdriver. A single change in the fan blades was enough to secure the desired product.

In all its literature the company emphasizes the centrifugal feature of the separation, claiming that it is the centrifugal force which makes the separation, the whirling body of air serving only as a vehicle to carry the particles and impart motion to them.

It is to be noted that ordinary variations in the speed of this machine did not affect the product in any way. This is a confirmation of the theory that the relation of forces is unaffected by changes in speed.

This separator is being successfully used in closed circuit grinding of cement clinker in some of the newer plants. The writer saw an installation at the Redwood City, Calif., plant of the Pacific Portland Cement Consolidated Co., San Francisco. There are other installations of the kind on the Pacific coast where the use of air separators in cement clinker grinding is almost standard practice. The makers say that the Gayco is also used in cement plants in Mexico and Japan and in a great many plants for grinding talc, feldspar and other rock products.

The Gayco separator is also marketed by the Patterson Foundry and Machine Co., East Liverpool Ohio, and is known as the Patterson separator.

General Contractors Map Out Program

MARKED by determination and directness of action, a meeting of executive groups of the Associated General Contractors of America was held at Washington, recently, for the purpose of a "stock-taking" of current affairs in the construction industry. Members of the association's executive board, advisory board, presidents' council and secretaries' council participated in the four-day conference.

It is doubtful if problems of the construction industry ever were discussed with more intensive earnestness than during the course of the sessions last week. Leaders of the association and executives of a large number of local units of the parent body from all sections of the country were present to lend the benefit of their thoughts and experiences to the meeting.

The discussions and actions that developed during the four-day meeting may be divided into two classes:

(1) Efforts to increase the efficiency of construction operations of all types, mainly by routing the irresponsible bidders.

(2) Efforts to eliminate unethical practices from construction relationships, with equal attention being given to the activities of all elements of the industry and to the attitude of the building public.

Special attention was given the subject of accident prevention, the topic being given prominence during the separate meeting held by the building division on May 3 and during the meeting of the secretaries' council. The A. G. C. Accident Prevention Manual came from the press just before the meeting opened, and this fact did much to center additional attention upon the problem of reducing the chances of mishaps befalling men engaged in construction work.

A timely action was taken in adoption of a resolution relative to problems connected with flood control and prevention of recurrence of the disaster that now holds southern states in its grip. The resolution asserted the national importance of the task of flood control and called upon President Coolidge to appoint a commission of engineers and executives to study all means for providing assurance against a return of present conditions in the valleys of the Mississippi River and its tributaries.

The second day of the meeting was devoted to separate sessions of the highway division and of the building, public works and railroad divisions.

The highway section gave lengthy consideration during its separate session to various methods for preventing irresponsible bidders from entering upon highway work. The Wisconsin system, under which bidders are qualified before lettings are held, was discussed. Along the same general line, promotion of the use of standard questionnaires was given close attention. The afternoon session was devoted in large part to consideration of plans for appointing a highway secretary as a member of the staff of the national association. A resolution on this subject later was presented to the executive board.

Quantity survey operations in many parts of the country were studied by the building section.

A survey of the day-labor situation was made and lines were drawn for upholding the contract system of handling public works construction.

The board adopted the proposed standard form of proposal, with the minor changes voted by the building division. Sub-headings carried by the form include: Definitions; proposal and contract; adequacy of structure; responsibility for design; omissions in plans; error and uncertainty in plans; excavation; foundations; designation of workmanship and materials; precedence of contract documents; contractors' guarantees; tornado, earthquake and hail insurance; completion time and liquidated damages; separate contracts; occupancy of structure, and acceptance of proposal.

The meeting was told of the results of representation of the A. G. C. on the committee appointed by Secretary Hoover to draft a model lien law. It was pointed out that the major points up for discussion before the committee are the liability of the owners for dual payment and the use of complicated sworn statements. The general principles set forth in the brief presented to the committee by the A. G. C. were upheld.

Attention was given to efforts to replace "blind worship of the low bid" with competition for construction services. Means by which direct advertisements may be utilized in emphasizing upon the public mind the necessity of buying services and not "prices" were outlined. It was stated that permanent results had already been gained where such a campaign was undertaken.

Subjects that were discussed included: Appraisal work; limiting awards of highway contracts made by foreign contractors doing their first jobs for a particular state; right to withdraw highway bids prior to openings; arbitration; establishment of contact between A. G. C. Chapters and the State Highway Departments; proper charge for equipment; unsound provisions in highway specifications; cubing buildings; co-operation with local A. I. A. Chapters; separate contracts; work of the Mixer Manufacturers' Bureau; the revised A. G. C. Manual and additions made to the contents for 1927; Secretaries' Manual, and reports of various committees.

The board voted that the next annual meeting of the association be held at either French Lick Springs or West Baden, Ind., and that the next meeting of the executive board be held at Birmingham. Exact dates for these meetings are to be set by President Sollitt. The annual meeting will be held early in 1928 and the board meeting probably will convene some time in October.

Recent Development in Sand and Gravel Storage Systems

Chillicothe, Illinois, Plant of the McGrath Sand and Gravel Company

By C. S. Huntington
Engineer, Link-Belt Co., Chicago, Ill.

Belt conveyor and tripper storage system with reclaiming tunnel conveyor at the Chillicothe, Ill., plant of the McGrath Sand and Gravel Co.

MOST sand and gravel washing plants located in the northern half of the United States can be operated only during a short season of eight to ten months.

At some plants material must be shipped during the entire year. At other plants the market calls for only a small quantity of material during the early spring months, while during the summer and fall, the demand exceeds the plant capacity.

This condition means part-time production during the early season and over-time operation during the peak months. To balance the production and demand, some sort of storage arrangement is required to enable the plant to run at full capacity during the lean months and to ship more than the washing plant capacity during the months of heavy demand, without over-time production.

The type of storage system must be designed to fit the plant site and requirements. For a plant with an average capacity of 50 cars per day or over, the belt conveyor and tunnel system offers a satisfactory solution of the storage problem.

During the fall of 1926, a storage arrangement of this kind was put into operation at the plant of the McGrath Sand and Gravel Co., located at Chillicothe, Ill.

The gravel from the washing plant bins is spouted on to a 24-in. belt conveyor, 190 ft. centers, running parallel with the bins and railway track. This conveyor discharges into a two-way spout. If mixtures are to be loaded, the material is drawn in the proper proportion from the bins to this belt, and the spout set to load this mixture directly into the car.

If it is desired to store material, the size to be stored is drawn on to this belt, and the two-way spout set to deliver to a second 24 in. conveyor, running at right angles to

Storing out-conveyor with tripper discharge through which gravel is discharged at any point

the first conveyor and the railway tracks.

This second conveyor or storing-out conveyor is about 510 ft. centers. The first 165 ft. is on a slight incline and the rest of the conveyor is horizontal. The horizontal portion is carried on a steel truss with three spans of 110 ft. each. A self-propelling steel frame tripper operates on this truss and discharges the gravel at any point desired.

Under the storage pile is a reinforced-concrete tunnel with a 24 in. tunnel conveyor, about 400 ft. centers. Suitable gates are set in the top of the tunnel and discharge the gravel from the storage pile on to the tunnel conveyor. The tunnel conveyor discharges on to a 24 in. inclined loading out conveyor of about 125 ft. centers. This conveyor discharges directly into cars.

Each of the conveyors is driven by a General Electric motor through a Link-Belt silent chain in oil-tight casing to the conveyor counter shaft. A pair of spur gears is used between the counter shaft and head shaft.

The troughing rolls are of the five-pulley "Multi-Roll" type with plain bearings and fitted with industrial Alemite lubrication.

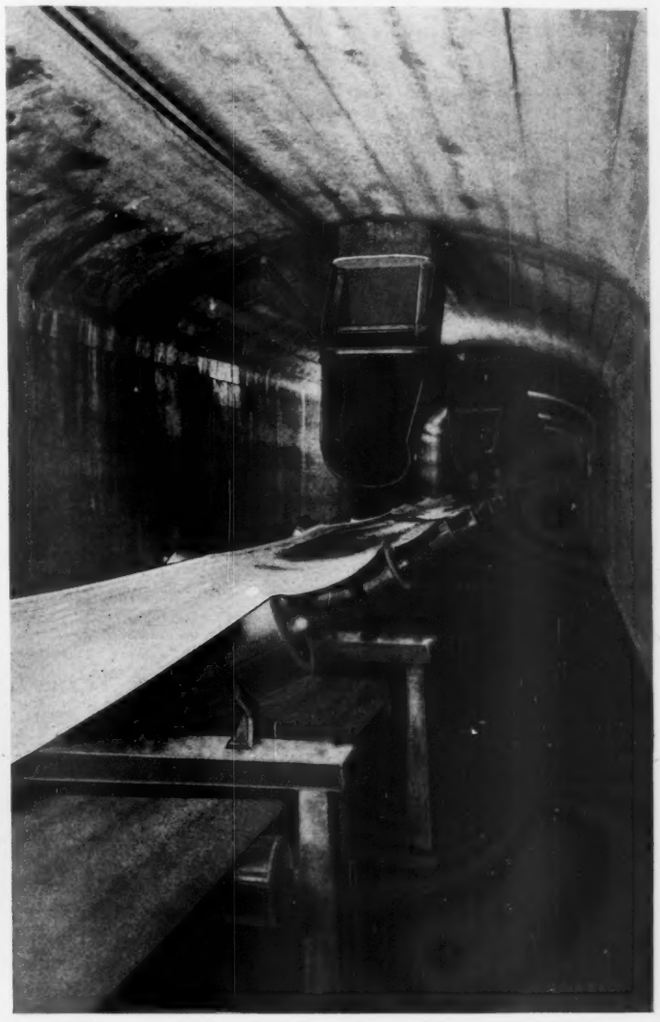
With the exception of the tunnel conveyor, the belts are kept in the proper tension by automatic gravity type take-ups. The tunnel conveyor is fitted with screw type take-ups.

The Link-Belt Co. designed the wood and steel structure, concrete tunnel and foundations. The building of the trestles (except the steel truss), the construction of the tunnels and foundations, and the erection of the machinery was done by the plant workmen under the direction of Fred Larcher, the plant superintendent.

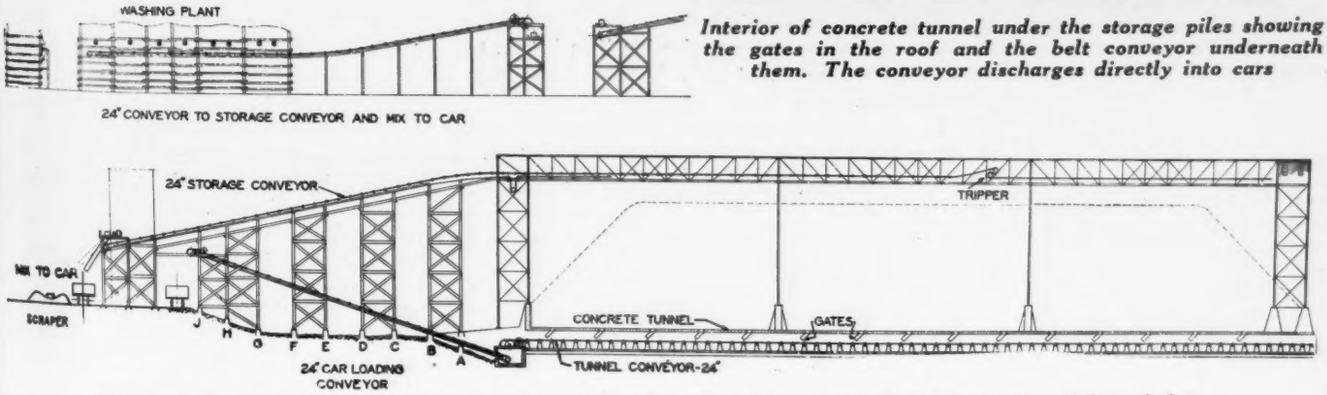
The steel truss was built and erected by the Mississippi Valley Structural Steel Co.

All of the machinery except the motors was manufactured by the Link-Belt Co.

The storing-out conveyor is carried on a steel truss with three spans of 110-ft. each



Interior of concrete tunnel under the storage piles showing the gates in the roof and the belt conveyor underneath them. The conveyor discharges directly into cars

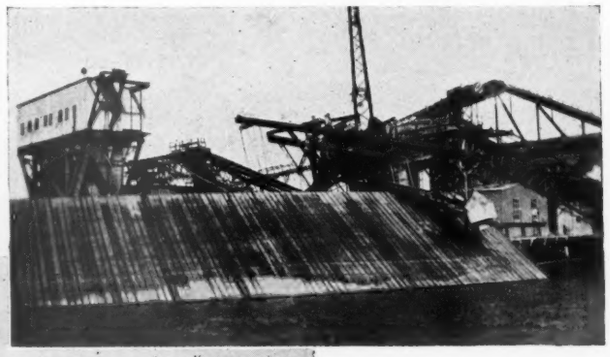


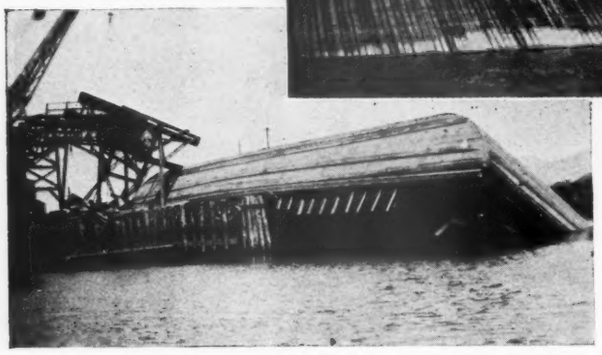
Plan and elevation of storage system at the Chillicothe, Ill., plant of the McGrath Sand and Gravel Co.

Manor Sand and Gravel Plant Damaged by Rolling Barge

THE well-known Manor Sand and Gravel plant of the Charles Warner Co., at Tulleytown, Penn., was badly damaged recently by an unsual accident. A barge which was being loaded with pebbles (or gravel) turned over and wrecked the structure which supported one of the conveyor belts by which barges are loaded at the docks, putting the plant out of commission for 48 hours. Concerning the accident, the *Warner-American News* says in part:

Suddenly and without warning the barge listed sharply away from the wharf and then, recovering, rolled in the opposite direction toward the wharf and turned completely over, dumping the load of pebbles in the water and finally coming to rest partly on the dock.





The upper photograph shows bottom of the barge and damaged conveyor structure. The lower gives a better idea of the position of the barge

As the barge came down on the dock it struck the steel members which supported the offshore end of the belt conveyor. Deprived of this support, the conveyor frame buckled and the whole outboard end of the conveyor, the outriggers and loading chutes came down in a tangled mass of wreckage.

After surveying the damage, which made it necessary to stop all operations until it was repaired, Superintendent Wills realized that to remove the barge with the equipment available at Manor would be impossible. He therefore immediately got in touch with a wrecking concern in Philadelphia and engaged the services of a floating crane of large capacity and this was on the job a few hours after the accident.

Working like beavers, some order began to appear out of the chaos of twisted metal, although it was estimated by many that it would take at least a week of hard work to have the plant again in operation. As night came on, flood lights were installed to illuminate the end of the pier and the work continued without let up.

So well did the men apply themselves, working night and day, that on Friday afternoon, a little over two days after the accident, the conveyor belt was in condition to operate, and by six-thirty that evening the loading chutes were in position and the plant in operation.

The most fortunate part of the whole accident is that no one was hurt. When the accident occurred Captain Huhn was standing on the bow deck of the barge and as it turned over it threw him onto the pebble wharf, where he alighted without injury. The pebble loader, whose duties require him to be on the wharf, saw what was happening and without hesitation plunged overboard from the opposite side of the wharf and swam ashore. Both of these men are fortunate that they escaped injury.

The plant has been running steadily ever since it was repaired in such quick time.

Large Texas Gravel Producers to Open New Pit at Eagle Lake

GEMMER & TANNER, the well known firm of gravel producers, operating a large pit at Columbus, near Houston, Texas, have planned to begin a new operation at Eagle Lake, according to the Eagle Lake *Headlight*. Rails are being laid for a connection with the main line of the Santa Fe.

It was said that prospecting only a small part of the deposit has developed about 2,500,000 tons, enough to justify the building of a fair sized plant.

An 80-ton locomotive has been bought to bring the gravel from the plant to the main line.

Charles Andres Named New Superintendent of Knickerbocker Portland

CHARLES ANDRES, former assistant superintendent of the Knickerbocker Portland Cement Co., Hudson, N. Y., a subsidiary of the International Cement Corp., and who has been in charge of the Houston, Texas, plant of the corporation for several years, has been appointed superintendent of the Knickerbocker plant here to succeed Edwin Struckmann, who has been promoted to the position of general superintendent of the eastern plants of the International corporation. Mr. Andres has already taken up his new duties at Hudson.

Mr. Andres is a veteran of the World War, having entered the service in Hudson at the outbreak of the war. He resided in Hudson a number of years before being sent to the Texas plant and has a large circle of friends in Hudson and in the cement industry who will learn with pleasure that he is again back at the Hudson mill.

A. C. Fieldner Made Superintendent of Bureau of Mines Stations

ARNO C. FIELDNER, superintendent of the Pittsburgh experiment station of the United States Bureau of Mines, Department of Commerce, has been appointed to the position of chief enginer, Division of Experiment Stations, of the Bureau, effective July 1. In his new position Mr. Fieldner will correlate the scientific activities of the Bureau's experiment stations located at different cities.

Mr. Fieldner, who has served as superintendent of the Pittsburgh experiment station for the past six years, is rated as one of the Bureau's outstanding research specialists. He is regarded as an authority on the technology of coal, coke and gas, and ventilation problems, involving noxious gases in mines, tunnels and elsewhere, and has served as chairman or member of several important fuel and gas committees in many different associations, notably the American Society for Testing Materials, American Chemical Society, American Gas Association, American Institute of Mining and Metallurgical Engineers, as well as others.

He has also contributed a large number of articles to the scientific and technical press and is the author of a long list of bulletins and other publications of the Bureau of Mines. Two years ago he was invited to become a member of the Coal Research Club of England.

Tennessee Output of Rock Phosphate Increased in 1926

A PRELIMINARY digest of the mineral resources of Tennessee and of the number of employes involved in production, embodied in the annual report of the division of mines, shows that the production of rock phosphate in 1926 showed an increase in tonnage and total value.

The production of blue phosphate rock was 44,895 tons in 1926 and was mined in Lewis county. In Giles, Hickman and Maury counties, 407,565 tons of the brown phosphate was produced, the total production of the state being valued at $2,293,854, which was $483,021 more than the productin of the previous year.—*Nashville* (Tenn.) *Banner.*

X-Ray Study of Limestone Calcination

Part I.— History — Theories of Atomic Structure — Application to Chemical and Technologic Processes

By Dr. Friedrich Rinne
Director of Minerology and Petrography, University of Leipzig, Germany

I AM giving below a review of the methods used in making x-ray studies of inorganic materials, followed by a discussion of the structure of two important substances, limestone and clay, and of their behavior during the calcination process.

This remarkable physical phenomenon was discovered 32 years ago by Roentgen, who gave it the name of x-rays to indicate that he was unable to determine the true nature of this activity. In honor of the discoverer, this phenomenon is now referred to as Roentgen rays. This seems the more reasonable, as the mysterious, strange nature of the x-rays has now disappeared. Their nature has been definitely established. We will come back to this point later; in the meantime, it remains an expression of tribute to the discoverer to designate his discovery by his name. Therefore, Roentgen rays!

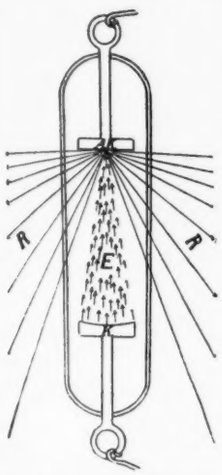


Fig. 2. An x-ray tube. Electrons E are discharged from the cathode K; these strike the anticathode AK, which sends out x-rays

Roentgen placed in the hands of scientists and practical men a device for the sounding of the infinitesimal: the atomic structure of matter. We thus enter a domain which has occupied the minds of philosophers for many centuries and even thousands of years. Twenty-five hundred years ago Egyptian and Babylonian wisdom merging with that of the Hellenes in Greece, marked a period when attempts were made to clear the innermost structure of matter.

I need merely mention the theories of Democritus and Epicurus, transmitted to us in the book "Lucrez De Rerum Natura." It contains the familiar atomic theory, which today constitutes the fundamental principle of our conceptions. The atomic theory has given rise to three branches of study; stereochemistry, stereophysics and crystallography.

At this point we might go back to the interpretation given by Huygens. He assumed calcium carbonate (limestone) to be composed of spherical particles, grouped uniformly to form a definite structure and

THIS article is the first of a series of three, two by Dr. Rinne and one by Dr. Marie Farnsworth on x-ray studies of lime burning. Realizing that many of our readers are familiar with x-rays and their operation, only in an off-hand fashion, this paper presents a brief historical review of their discovery and the theory and fact upon which their application in the rock products industries are based. This is all told in a manner simple and interesting and which gradually paves the way for a better comprehension for the following articles, which are of a necessity more technical in nature. Dr. Rinne's articles were prepared especially for Rock Products. He is the foremost authority on the subject in Europe.— The Editors.

tried to explain the characteristic cleavage, the unusual optic properties and the hardness variation with relation to the direction of the crystals on this basis. The founder of modern crystallography, Rene Just Hauy,

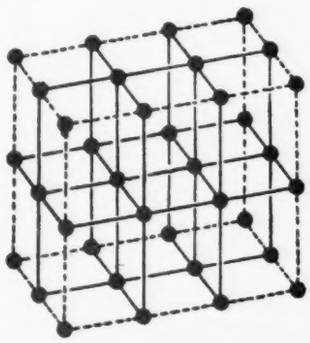


Fig. 3. Stereochemical diagram of atomic structure

also tried to classify his objects of study on the basis of their structure. Here also calcium carbonate (limestone) appears in the foreground. He imagined it and other similar substances built up of minute bodies constituting a core surrounded by a shell of tiny staggered plates.

This is the theory of integrated molecules and of "decrescence"! A fine fundamental theory indeed! However, there are things which cannot be reconciled with it. For example, assuming that rock salt is composed of the cubes, compactly built up upon one another, we fail to understand how it can be compressed further. This did not escape Hauy and he tried to correct himself at a later date. The idea of crystalline structure was furthered by A. Bravais who, instead of cubes, considered but their centers of gravity as units of structure. We thus come to the stereochemical diagram (Fig. 3). It consists of points, which occur repeatedly along the three volume dimensions and, consequently, in planes and elementary volumes. It is a "tri-dimensional periodicity." This was to be the structure of substances called crystalline.

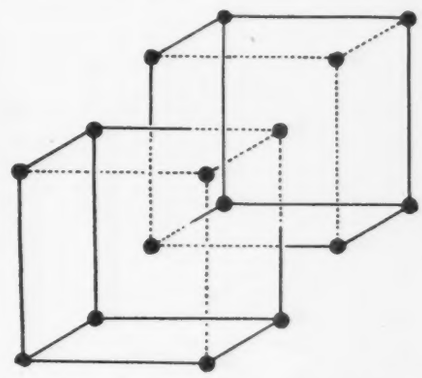


Fig. 4. Superimposed cubes (Point system)

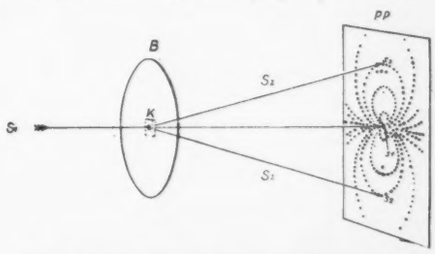
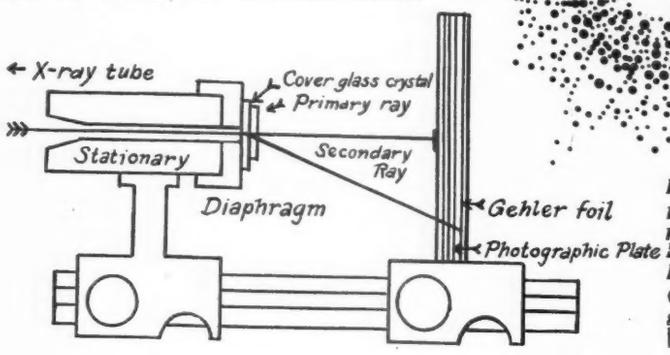


Fig. 6. The Laue effect. The primary x-ray S_1 passing through the disc B strikes the crystal K, which emits secondary deflected rays in addition to the primary. The rays are reproduced on a photographic plate forming the points of the Laue diagram, which becomes apparent upon developing the negative

According to Bravais, the points freely suspended in accordance with the stereochemical diagram, were the molecules. Thus the molecules of crystals were grouped conforming to definite volume relations. This, however, was not proven.

P. Groth, professor of mineralogy in Munich, working in collaboration with his colleague, the physicist Sohncke, tried a bold experiment. They assumed atoms to be the points in the stereochemical diagrams. By constant repetition of their periodicity, they claimed to obtain a crystal. There remained the problem of substances composed of more than one element, such as sodium chloride consisting of sodium and chlorine. To this end Groth and Sohncke advanced the theory of superimposed or inscribed cubes (see Fig. 4). Thus assuming a cube of substance A and B, the latter is introduced into the former so that one of its corners coincides with the center of the first cube. Thus each element forms its own volume diagram, which are combined with constantly recurring regularity. The point system was thus elaborated built up of atoms, one cube inserted into another.



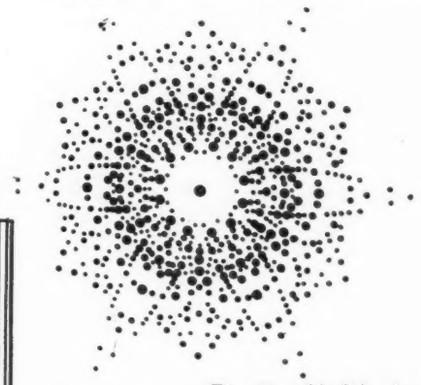


Fig. 7. (Left) Apparatus for the reproduction of the Laue diagram by F. Rinne, and Fig. 8 (above) Laue diagram of a beryl. [Photographed by F. Rinne]

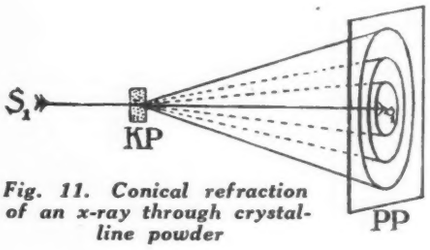


Fig. 11. Conical refraction of an x-ray through crystalline powder

Nineteen twelve was a fruitful year for the volume placement theory. We owe it to the efforts of a young physicist in Munich, Max von Laue. He began by questioning: What are x-rays? Similar to cathode rays they could be composed of small particles emanating into space, or, similar to ordinary light, they could be waves of short length. If this were true, refraction phenomena would be observed, such as noted when holding a woven piece against bright light, undoubtedly familiar to every reader. Many attempts were made to produce refraction of x-rays by making extremely fine latticed cubes; this fineness, however, was insufficient to prove successful. Max von Laue was the originator of the idea that nature had provided the finest latticed cubes in the form of crystals. He, therefore, used crystals to produce refraction of x-rays. The first test, recommended by him, was nevertheless carried out by others, namely, two of his friends at the Physical Institute, Munich—Knipping and Friedrich. Fig. 6 shows the Laue effect and the Laue diagram. It was a discovery of first order. It has been said that this was the most important physical discovery of the present century. It provided proof for the following:

1. X-rays are waves of light of infinitesimal fineness; they are a thousand times finer than those of ordinary light.
2. Crystals are built up of latticed cubes.
3. Atoms are actually present, as surely as the stars in heaven.

Let us consider an example of the Laue diagram (Fig. 8). A wonderful picture presents itself—the diagram of a beryl with its sparkling of refracted rays and the primary ray in the center. Naturally, this phenomenon can be treated but in a very general way in the present article.

The introduction of x-rays into scientific experiments is due to the deductions and experiments of two Englishmen, W. H. and W. L. Bragg. According to the latter, the Laue diagram may be treated as a reflection, the x-rays being reflected back from the planes of the crystals covered with atoms. The primary ray is not reflected regardless of the angle at which the rays penetrate, but only when a simple equation is satisfied: $n = 2\ d \sin \alpha$, where n is a number 1, 2, 3 . . . . . ; λ — the wave length; d — the distance of parallel planes in the cube and α the angle of reflection. The equation serves to determine values of d from readings of α and from the wave length λ. The relative position of the planes thus becomes established and, taking into account the intensities of reflection, the position of the individual atoms in the crystal can also be determined.

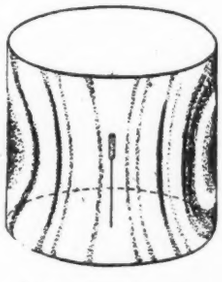


Fig. 12. An x-ray photograph in accordance with Debye and Scherrer

The results of these methods can be discussed here only in passing, perhaps taking as an example the structure of a diamond (Fig. 10). It consists of tiny cubes, which are marked by the location of carbon atoms. The sides of the cubes must be thought of as non-existent; they have been drawn in only to express the structure in geometric terms. Carbon atoms appear at the corners and at the center of the sides of the cube. A small tetrahedron is located inside the cube, marked by carbon atoms with great regularity and repeating itself in all directions thousands and millions of times. About 3,000,000 small elementary cubes are contained per mm. length of a diamond.

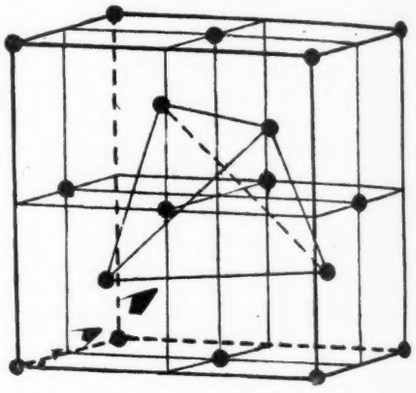


Fig. 1. Atomic structure of a diamond. The points indicate atoms of carbon

These and many other examples of crystalline structure were the results of Laue's and, particularly, Bragg's investigations. In this connection one should not imagine that these results are obtained as easily as the structure of samples is recognized under the microscope. Aside from observations we deal here with laborious computations, which, however, are highly worth while due to their importance from a scientific and technical standpoint.

We will now confront the question of how x-ray crystallography can be applied to technical and chemical processes. Great services were rendered in this connection by Professor Debye and his assistant, Scherrer. Debye was active at the University of Göttingen. It occurred to him that in dealing with earthy materials such as lime or chemical residues, finely pulverized materials in general, there was frequently no possibility of conducting researches on fine crystals in accordance with Laue's or Bragg's methods. The methods had to be modified to apply to pulverized materials.

The finest particles of such powdered materials, however, present planes from which x-rays are reflected. Thus reflections take

place actually in the fine, crystalline particles, the difference being that in a sample of this kind the primary x-ray penetrating the mass is surrounded by a series of reflecting surfaces. Refraction along the surface of a cone is thus produced (Fig. 11).

A practical application of this case consists in introducing the powdered sample in a cylindrical container, whose inner surface is covered with a film. The primary x-ray enters the cylinder through a hole and falls on the crystalline powder. Cones of refraction mentioned above are thus formed and the rays are recorded on the film (Fig. 12).

One need only remove the film and place it on a flat surface, and the measurements and computations according to Bragg's equation method may be begun.

The accuracy of such analyses may be illustrated by the fact that even particles of gold in extremely finely divided gold solutions can be discovered. In this case a proof was obtained that the colloidal gold particles were in reality tiny crystals.

E. Schiebold's name should not remain unmentioned in this connection. He was first to suggest the so-called balance diagrams and thus proved that the half spectra produced could be used for a graphical determination of crystalline structures.

Thus every substance presents a spectrum from which we may conclude its nature.

Lime for the Glass Industry

ALTHOUGH less than 2% of the total lime production of the United States is consumed in the manufacture of glass, the glass trade nevertheless forms an attractive market for many lime manufacturers, says Edwin P. Arthur in a recent issue of *Industrial and Chemical Engineering*. The business, though small, being less subject to fluctuations than building construction and especially welcome during dull seasons, the report continues. Lime manufacturers are at the present time supplying over 75,000 tons annually where 200,000 tons are required, the balance coming from raw ground stone.

Chemically the most important item is iron content, because of the green color which iron imparts to glass. First-class lime for glass-making should contain less than 0.2% iron oxide.

Lime for the glass trade should be slightly overburned. Off-color lime which might be unsuitable for building purposes would be quite acceptable for glass-making. Overburned lime does not hydrate so readily—a decided advantage in shipment and storage. Lime in the open storage bin of a glass factory on a river bank has been found to absorb as much at 9% H_2O in 10 days.

Little or no effort has been made by lime producers to furnish glass-makers with a product adapted mechanically to the process of glass manufacture. The ordinary finishing lime is so finely ground that it is difficult to handle in mixing and conveying machinery. Lime dust blown from batch in the furnace has a tendency to clog furnace flues and regenerators. It would appear desirable for lime producers to make a companion product for the "dense dustless" soda ash now in universal use. Tailings, screenings and rejects from an air separator might be recovered as an ideal product for glass-making.

Refractories Utility Chart

THE American Refractories Institute, Pittsburgh, Penn., has prepared an interesting chart on the utility of refractories under various conditions of service. The reproduction accompanying is self-explanatory and presents diagrammatically the factors causing refractory losses and the properties of the refractories. On the reverse side of the chart, there are temperature conversion tables. Copies of the chart are available upon application to D. A. Texter, secretary of the institute, 2202 Oliver Bldg., Pittsburgh, Penn.

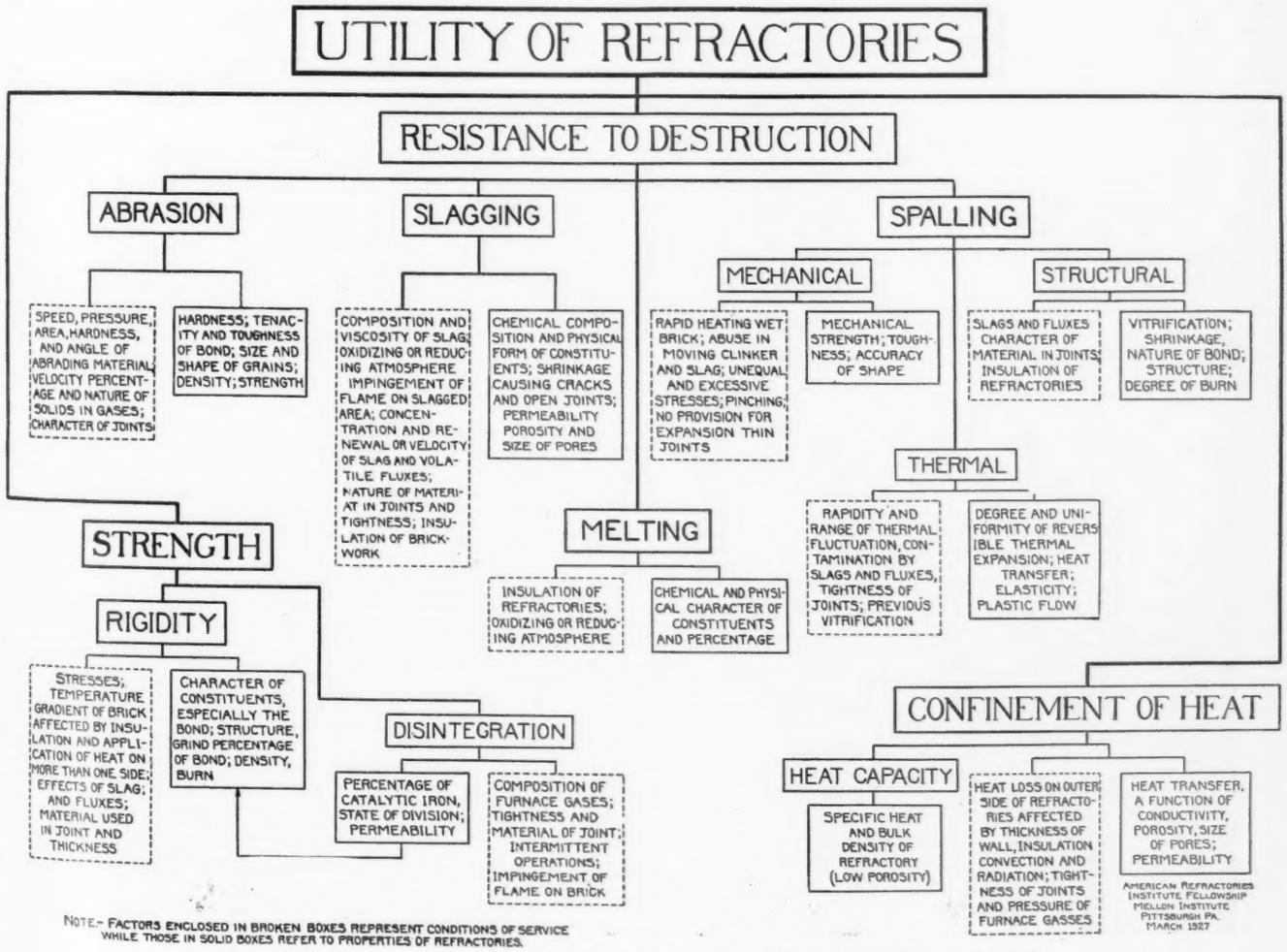

UTILITY OF REFRACTORIES
RESISTANCE TO DESTRUCTION
ABRASION
SLAGGING
SPALLING
MECHANICAL
STRUCTURAL
THERMAL
STRENGTH
RIGIDITY
DISINTEGRATION
MELTING
CONFINEMENT OF HEAT
HEAT CAPACITY
SPEED, PRESSURE, AREA, HARDNESS, AND ANGLE OF ABRADING MATERIAL; VELOCITY; PERCENTAGE AND NATURE OF SOLIDS IN GASES; CHARACTER OF JOINTS
HARDNESS; TENACITY AND TOUGHNESS OF BOND; SIZE AND SHAPE OF GRAINS; DENSITY; STRENGTH
COMPOSITION AND VISCOSITY OF SLAG; OXIDIZING OR REDUCING ATMOSPHERE IMPINGEMENT OF FLAME ON SLAGGED AREA; CONCENTRATION AND RENEWAL OR VELOCITY OF SLAG AND VOLATILE FLUXES; NATURE OF MATERIAT IN JOINTS AND TIGHTNESS; INSULATION OF BRICKWORK
CHEMICAL COMPOSITION AND PHYSICAL FORM OF CONSTITUENTS; SHRINKAGE CAUSING CRACKS AND OPEN JOINTS; PERMEABILITY POROSITY AND SIZE OF PORES
RAPID HEATING WET BRICK; ABUSE IN MOVING CLINKER AND SLAG; UNEQUAL AND EXCESSIVE STRESSES; PINCHING; NO PROVISION FOR EXPANSION THIN JOINTS
MECHANICAL STRENGTH; TOUGHNESS; ACCURACY OF SHAPE
SLAGS AND FLUXES CHARACTER OF MATERIAL IN JOINTS; INSULATION OF REFRACTORIES
VITRIFICATION; SHRINKAGE, NATURE OF BOND; STRUCTURE; DEGREE OF BURN
RAPIDITY AND RANGE OF THERMAL FLUCTUATION, CONTAMINATION BY SLAGS AND FLUXES, TIGHTNESS OF JOINTS; PREVIOUS VITRIFICATION
DEGREE AND UNIFORMITY OF REVERSIBLE THERMAL EXPANSION; HEAT TRANSFER; ELASTICITY; PLASTIC FLOW
STRESSES; TEMPERATURE GRADIENT OF BRICK AFFECTED BY INSULATION AND APPLICATION OF HEAT ON MORE THAN ONE SIDE; EFFECTS OF SLAG; AND FLUXES; MATERIAL USED IN JOINT AND THICKNESS
CHARACTER OF CONSTITUENTS, ESPECIALLY THE BOND; STRUCTURE, GRIND PERCENTAGE OF BOND; DENSITY, BURN
PERCENTAGE OF CATALYTIC IRON, STATE OF DIVISION; PERMEABILITY
COMPOSITION OF FURNACE GASES; TIGHTNESS AND MATERIAL OF JOINT; INTERMITTENT OPERATIONS; IMPINGEMENT OF FLAME ON BRICK
INSULATION OF REFRACTORIES; OXIDIZING OR REDUCING ATMOSPHERE
CHEMICAL AND PHYSICAL CHARACTER OF CONSTITUENTS AND PERCENTAGE
SPECIFIC HEAT AND BULK DENSITY OF REFRACTORY (LOW POROSITY)
HEAT LOSS ON OUTER SIDE OF REFRACTORIES AFFECTED BY THICKNESS OF WALL, INSULATION CONVECTION AND RADIATION; TIGHTNESS OF JOINTS AND PRESSURE OF FURNACE GASSES
HEAT TRANSFER, A FUNCTION OF CONDUCTIVITY, POROSITY, SIZE OF PORES; PERMEABILITY
NOTE:- FACTORS ENCLOSED IN BROKEN BOXES REPRESENT CONDITIONS OF SERVICE WHILE THOSE IN SOLID BOXES REFER TO PROPERTIES OF REFRACTORIES.
AMERICAN REFRACTORIES INSTITUTE FELLOWSHIP MELLON INSTITUTE PITTSBURGH PA. MARCH 1927

Chart for determining utility of refractories under different conditions of service

Hints and Helps for Superintendents

Novel Method of Screening and Bagging Lime

By JULIAN CONSOLINI

Lee Lime Corp., W. Stockbridge, Mass.

WE store our agricultural lime near our rotary kiln and cooler. This lime had to be screened and bagged by hand at considerable cost, so I decided to try to find a quicker method. We had on hand a Link-Belt coal conveyor, 30 ft. long. This I put at the discharge end of the cooler, which has a screen at the end. I then shoveled the lime on to the conveyor, which carried it and emptied it into a chute leading into the cooler. The cooler, while rotating, screened the lime.

A screw conveyor under the cooler which takes our Globular finishing lime to storage tanks also served to take the agricultural lime to an empty tank, from which it afterwards was bagged from a chute in the same manner as the Globular. The men handled all our agricultural lime this way without having to carry it by wheelbarrow to the conveyor, as this conveyor could be swung to any position desired.

The next problem was to keep the dust away so that the men could work. They had never worked in this kind of lime dust before, and it was getting the best of them. I extended an air line from the one in our quarry to where the men were working. The pipe was placed about 8 ft. in the air and so as to blow upwards. Sufficient air discharge to keep the dust away from the men was let in. In this manner the air took away the light dust as it was lifting and blew it out of a window near by. The men are able to work much better and get more work done.

Novel method of screening and bagging lime

Chain Mat Reduces Danger of Flying Rock in Blasting

A GREAT proportion of accidents which occur during secondary blasting result from workers being hit by fragments thrown by the blast. As a rule much of this can be prevented by placing piles of logs, railroad ties or brush over the hole before firing. An interesting device and one which appears to be quite efficient is a chain mat described by C. S. Hurter in a recent issue of the *Du Pont Magazine*, which is in use at the Oliver Iron Mining Co. The chain mat as shown in the accompanying illustrations is placed directly over the bore hole just before a springing shot is to be fired. After the blast, the mat is removed and stored or placed over another hole. The advantages of this device are quite apparent to say nothing of the time savings over the ordinary methods of piling logs, etc.

A close-up view of the mat in place

To prevent spalls from being thrown from springing shots in snake holes, some operators use cylindrical blocks of hardwood bound around with two flat steel bands and provided with two handles. The block is placed directly in front of the snake hole and about two or three feet distant from it.

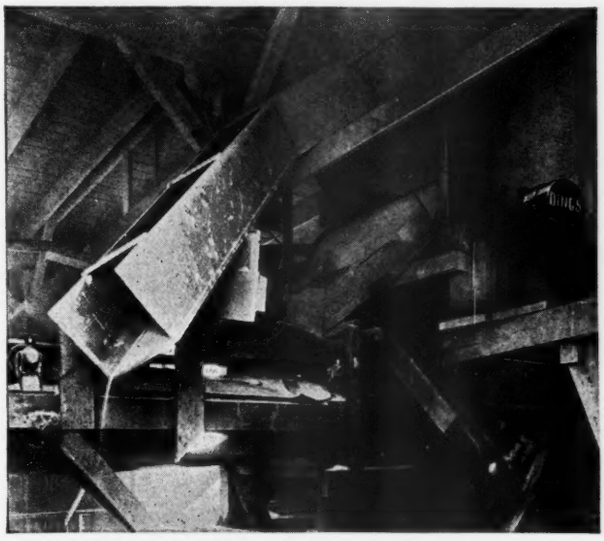
Ready to place a chain mat over the bole hole shown in the foreground. Such a device reduces danger from flying missiles

Unusual Magnetic Separation in Preparing Glass Sand

AN unusual method of separating from glass sand magnetic materials, such as hematite, magnetite, ilmenite, minute particles of iron abraded from the surfaces of crushers, screens or other iron machinery and particles of iron attached to sand crystals or entirely included in them, has been installed in the plant of the United States Silica Co. of Ottawa, Ill. The process which is used in the manufacture of a sand of low iron content necessary to meet the requirements of glass manufacturers where the color of the glass is of importance has been developed in order to submit large quantities of sand to the high magnetic intensity and makes use of a large capacity magnetic pulley with the material passing directly over the bare face of the pulley instead of over a belt as is the usual practice.

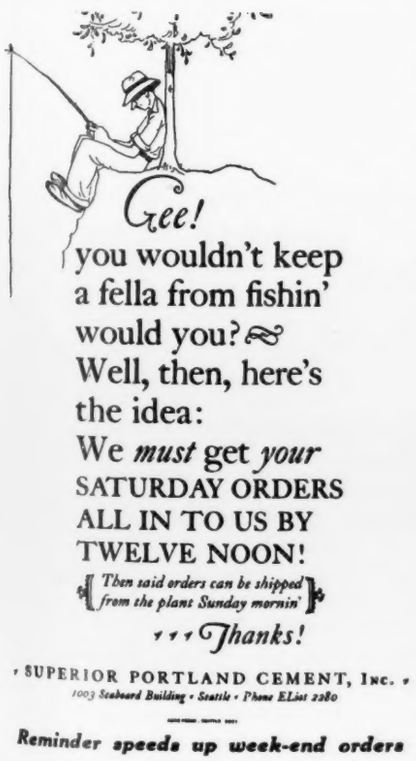
The sand which is originally obtained by the disintegration of a high grade sandstone is first submitted to intensive washings which eliminate the alumina and other non-magnetic materials contained in the sandstone. The sand is then fed by gravity from a large hopper in a thin stream, directly onto the bare face of a 48-in. Dings magnetic pulley on which the maximum current is carried. The high magnetic intensity is said to cause all particles of magnetic material to adhere to the face of the pulley, including even the crystals with iron attached or with iron entirely included within them.

In order to remove magnetic particles collected on the face of the pulley a special control mechanism has been installed which demagnetizes the pulley for a few seconds. approximately once every minute. At the same time a stiff brush extending the full width of the pulley is brought to bear against the pulley face on the bask side. This brush, operating while the pulley is demagnetized for a second or two, removes all magnetic particles which have been seized, the collected magnetic particles falling into another chute. Immediately the face of the pulley has been brushed clean the magnetizing current is again applied by the automatic control mechanism. The entire cycle is repeated approximately once a minute.



Unusual method of separating magnetic particles from a glass sand

The design of the apparatus and automatic control was worked out by engineers of the Dings Magnetic Separator Co. of Milwaukee working in co-operation with the U. S. Silica Co. Approximately 75 tons of sand per hour are handled by the separator.



Reminder speeds up week-end orders

Speeding Up Week-End Orders for Material

A LITTLE reminder which helps make blue Monday take on a somewhat happier hue is shown at the left. Every rock products producer knows how annoying it is to get orders late Saturday for delivery on Monday, with only a few employes to fill them with. As a consequence, on Monday, if the material is show in arriving on the job or yard, the contractor or dealer burns up the wires in a vain attempt to speed up deliveries. The Superior Portland Cement Cement Co. sends these little appeals to its customers and the results are said to be quite gratifying.

Estimating Quantities of Materials in Concrete*

THE following is a simple and accurate method of determining the quantities of materials required for a unit volume of concrete of any mix. This method is based upon the fact, established by tests, that the volume of concrete produced by any combination of materials, so long as the concrete is plastic, is equal to the absolute volume of the aggregate plus the absolute volume of the cement plus the volume of water. The absolute volume of a loose material is the actual total volume of solid matter in all of the particles. This can be computed from the weight per unit volume and the specific gravity as follows:

$$\text{Absolute volume} = \frac{\text{sp. gr.} \times \text{the unit weight of water}}{\text{unit weight}}$$

Example: Suppose we use a 1:2.2:3.6 mix and a water cement ratio of 7 gal. per sack. Fig. 1 sack of cement equals 1 cu. ft., weighs 94 lb. with a specific gravity of 3.1. Fine aggregate weighs 110 lb. per cu. ft., coarse aggregate 100 lb. per cu. ft. and their specific gravity is about 2.65. The volume of concrete produced by the above mix is calculated as follows:

$$\text{Cement} = \frac{94}{3.1 \times 62\frac{1}{2}} = 0.49 \text{ cu. ft.}$$

$$\text{Fine aggregate (F. A.)} = \frac{110 \times 2.2}{2.65 \times 62\frac{1}{2}} = 1.46 \text{ cu. ft.}$$

$$\text{Coarse aggregate (C. A.)} = \frac{100 \times 3.6}{2.65 \times 62\frac{1}{2}} = 2.18 \text{ cu. ft.}$$

$$\text{Volume of water} = \frac{7.0}{7.5} = .93 \text{ cu. ft.}$$

Total volume of concrete produced 5.06 cu. ft.

Quantities for 1 cu. yd. of concrete:

$$\text{Cement} = \frac{27}{5.06} = 5.34 \text{ sacks or } 1.33 \text{ bbl.}$$

$$\text{F. A.} = \frac{5.34 \times 2.2}{27} = 0.43 \text{ cu. yd.}$$

$$\text{C. A.} = \frac{5.34 \times 3.6}{27} = 0.71 \text{ cu. yd.}$$

For unusual materials such as blast furnace slag, special light weight aggregates, etc., the exact specific gravities should be used. It will be found that for the purpose of estimating quantities the average value—2.65, given above, will be sufficiently accurate for sand and gravel and the common varieties of crushed rock.

For very porous aggregates corrections should be made for the quantity of water absorbed, for the volume of concrete produced will be reduced directly by this amount. For very wet mixes a further correction may be required due to water lost in handling.

**Concrete Highways and Public Improvements* for March.

Editorial Comment

The Absorption of Freight Rates

THOUGHTLESS and ill-considered price-cutting is the bane of nearly every producer's life, at least during periods when the producing capacity of an industry considerably exceeds demand. Most of the rock products industries are now experiencing such a period. One of the most common, but least tangible forms of price-cutting is the so-called "absorption of freight rates." It is probably more common in the rock products industries than in some others, because these industries are of necessity more local, with limited scope of distribution.

Nearly a year ago ROCK PRODUCTS editors began collecting data and opinions from leaders in its industries on this problem of absorption of freight rates. We did not fully realize at the time that we had tackled a very comprehensive and involved problem in economics, but nevertheless a very vital and practical one, not only to the well-being of these industries, but apparently to a great many others as well. Our investigation and our file of correspondence and notes on the subject have been brought out for this discussion by an article by Harper Leech, business writer, in the *Chicago Tribune* of June 15. As Mr. Leech's article bears so directly on our own discussion it is reproduced herewith as a preface:

Wonder what an orthodox "marginalist" economist would say as to the growing practice of producers taking business at or below normal cost to absorb overhead and keep organizations intact?

Discussing this question before the National Association of Cost Accountants yesterday Charles R. Stevenson revealed the results of a poll of thousands of American manufacturers. No better comment is available on the problems which face the business executive and the economist in this new industrial era than the title of the topic discussed by hundreds of accountants, controllers, treasurers, and other fiscal executives of leading American corporations here yesterday.

That was "The Economic Effects of Taking Business at or Below Normal Cost." Readers of this column, who may recall the proposition advanced here that the value of modern industries lie mostly in the maintenance of an efficient organization, continuously functioning, will have little difficulty in locating the causes of below cost business.

To the question, "Do you believe that business should ever be taken at normal cost?" the response of some 8000 manufacturers was: No answer, 2%; qualified yes, 15%; yes, 38%; qualified no, 3%; no, 42%. To the question, "Do you believe that business should ever be taken below normal cost?" the response was: No answer, 3%; qualified yes, 9%; yes, 14%; qualified no, 2%; no, 72%.

"Do you believe that the theory of incurring losses by taking business at or below normal cost, with the idea of absorbing overhead, is sound?": No answer, 3%; qualified yes, 7%; yes, 12%; qualified no, 4%; no, 74%.

"Do you believe that the financial loss incurred in keeping your organization intact by taking business at or below normal cost benefits you in the long run?": No answer, 4%; qualified yes, 9%; yes, 15%; qualified no, 3%; no, 69%.

"Do you believe that in the long run the gain from greater buying power sufficiently offsets the financial losses incurred by taking business at or below normal cost?": No reply, 6%; qualified yes, 2%; yes, 4%; qualified no. 1%; no, 87%.

"Do you believe that you can take business at or below normal cost without affecting adversely the industry of which you are a part?": No reply, 3%; qualified yes, 3%; yes, 6%; qualified no, 3%; no, 85%.

"Do you consider it fair to other concerns in the same industry to take business at or below normal cost?": No reply, 6%; qualified yes, 4%; yes, 9%; qualified no, 3%; no, 78%.

"Do you believe that any industry, as a whole, in its competition with other industries, should ever take business at or below normal cost?": No reply, 8%; qualified yes, 7%; yes, 9%; qualified no, 4%; no, 72%.

Evidently the noes have it and the importance of adequate profits is realized even in the face of new complexities; but on the other hand there is a prevalent belief that with the present over-extension of plant, interindustry competition, and controlled buying a majority of producers are taking at least some business merely to keep going. The smaller profit margins of the great majority of corporations certainly point that way.

Questions Asked

The specific questions asked various prominent producers by ROCK PRODUCTS were these:

Granting that the commodity produced and marketed may be regarded as standardized, what *percentage* of its selling price is it fair to absorb in freight rate? For example if the current price of lime in a certain market is $12 per ton, what percentage of $12 is it fair for a lime manufacturer to absorb to reach that market. Certainly it would not be right for a manufacturer with a $6 freight rate to invade this market against competition with a $2 freight rate. If 50% is too much, just what should be a fair figure?

What considerations enter this problem of absorption of freight charge?

Is the producer of a basic commodity ever justified in selling considerable quantities of it at a net plant price less than the cost of production? Is it feasible or desirable to have a basic plant price? Is it attempted to establish an average plant price in advance of a season? If so do you really try to adhere to it?

Is volume of business such an important factor in reducing manufacturing costs as it is commonly reputed to be?

Is it good business policy to absorb freight charges to excess in order to obtain business which cannot be held at current prices just to obtain temporary increases in volume?

What rules would you suggest to guide producers in this matter of absorption of freight charges?

Probably the answers would be more interesting if we were to name the authors; but most of them did not wish to be quoted. We can only assure readers that each and every individual quoted is a chief executive of a large corporation producing portland cement, lime, crushed stone or sand and gravel. Each man is nationally recognized as an outstanding figure in his industry and as a man who has made his company prosperous. ROCK PRODUCTS is vastly indebted to them for the time and thought they have given the subject. We trust this summary will inspire further thought along the same lines.

It was presumed that the fundamental principles involved apply to any basic material—cement, lime, gypsum, crushed stone, gravel or sand. Nature has given each plant or group of plants a certain accessible market territory. When demand in this territory slackens, or ceases to justify the full production of these plants, they naturally seek to broaden their market territory. This usually means the invasion of markets already served by local plants. Since freight rates, or motor-truck transportation costs, are very generally on a mileage or zone basis, and the material is sold at the local prevailing price, the absorption of freight rates or transportation costs results in net plant prices lower than competitors consider fair, and these may easily become lower than actual cost of production.

The problem is by no means so simple as stated, nor is it possible to state it simply because through a reduction in price levels often a producer is compelled to absorb freight rates to excess to hold markets that have been his, which are threatened by new producers placed nearer to them. In other words, absorption of freight rates may be a defensive as well as an aggressive measure, which complicates its discussion from ethical as well as other angles.

Of course the big problem involved is how much loss or punishment shall the individual producer take for the good of the industry as a whole; for almost without exception producers admit that the practice is bad for the industry as a whole. And right at the start it may be said that there is no other positive guide than the Golden Rule, or the acceptance of the policy of live and let live. But in this day of keen competition between industries it is conceivable that a policy of live and let live carried to extremes would result in a group of competitors all dying together at the hands of a more aggressive competitive industry, if they allowed inefficiency and high costs to govern their industry.

Limits to Absorption of Freight Rates

Here are some specific suggestions from prominent producers—and thoughtful men:

It is my opinion that the absorption of freight rates on a high quality material selling for approximately $10 a ton, for the good of the industry, should not exceed $1 per ton, and, in fact, 50c a ton would seem to be more reasonable from a commercial standpoint. If, due to quality and service, a manufacturer having a high grade material in one district, desiring to ship many miles out of his reasonable territory, should not meet the lower freight rate of his small competitor, it is altogether likely that the customer, in order to get the particular quality desired, would be entirely satisfied to pay the freight differential. I think the spirit of live and let live, and a maximum freight absorption of reasonable amount, for example, not over $1 per ton, is the only rule that would seem to fit the case.

* * * * * * *

Granted that it is fair to absorb freight rate at all, then from 10 to 20% is logical, and for these reasons: Roughly speaking, the factors entering into the selling price of a raw material crudely manufactured are more or less similar and may be divided approximately as follows:

Profit	10%
Depreciation and amortization	10%
General overhead	10%
Plant overhead of non-producers	10%
Out-of-pocket cost	60%

Of course, these advantages will vary somewhat with different characters of the business and also with different producers in the same business, but it is an approximation which will serve the purpose of illustrating my thought.

In illustrating the application perhaps $1 selling price is a convenient figure to assume. If required to operate for business in hand, then it is self-evident that it is to the economic advantage of the producer, at least temporarily, to take on in addition any business at a price something better than 60c a ton; and of course economically and beneficially the more nearly it approaches the higher limit. There are hundreds of reasons why this may be an unsound policy; I am only speaking of the temporary benefit involved in the specific consideration.

Of course this is the underlying principle of dumping on a competitor, or competitors; who have the same opportunity of retaliatory dumping in your territory.

On the other hand, suppose there are two producers in the same market, one with a freight advantage of 10c a ton over the other. If the two producers have just sufficient capacity to supply the market, then of course each one can charge anything he pleases, within limits; but if their combined capacity is somewhat in excess of the market, then it is a perfectly illogical situation for the producer less favored as to location to sit back and wait for his competitor to take all the business he can produce and be satisfied with what is left. Therefore, the less favored producer must invade the other's market or substantially quit business, because if he invades the market at a sacrifice of his profit of 10c, which is equivalent to the difference in freight rate, he at least survives and would ultimately earn his investment back through the amortization charge, although he would lose the interest on his money. Economic pressure, however, would force him to take some of the business.

The next step in such competition would be for the more favored shipper to lower his prices a little more in competition, and so the fight would continue until the less favored shipper would be down to his out-of-pocket cost of 60c and the other shipper down to 70c, which of course spells disaster for both. The solution of this problem is some sort of agreement between the two shippers, and there comes the rub. There can be no definite agreement between them without conflicting with the law, especially on interstate shipments, and there is no well recognized principle by which the two can live satisfactorily except by some indefinite, uncontrollable live-and-let-live principle. Eddy's Plan of open competition is probably the nearest approach within the law of any plan I know of for harmonizing these difficulties between competitors. This is, broadly speaking, merely an exchange of quotations supplied one to the other after they have been made, giving each competitor the opportunity, if he so desires, of cutting his price and seizing the business if he thinks it is to his advantage, all things considered, to do so. The only control in this relationship is merely a sense of fairness between competitors that, notwithstanding some individual competitor has an advantage over others, he cannot hope to secure all the business at his own prices because he will stimulate a retaliatory spirit on the part of a party less favored and he therefore must yield

something to the others, either in the spirit of fairness, or in the spirit of expediency.

It therefore seems to me that the first two questions have been involved in this last discussion and might be answered by saying that freight rates to the extent of 10% of the selling price might be absorbed and the territory within this radius considered free for all.

* * * * * * *

I would say that we always absorb a very small percentage of freight rates, not over 10c a ton, rare exceptions 15c a ton (on crushed stone).

* * * * * * *

We base our selling price of sand and gravel almost strictly on the base price of the commodity at the shipping point; in very rare cases are we willing to meet a competitor's delivered price when it involves not more than 5c or 10c cut on our base price in order to absorb a portion of the freight rate. Where there is a difference of from 15c to 25c per ton as between two plants, we do not try to equalize our price in order to make a delivered price to compete with a competitor with a lower freight rate. The only consideration that enters into the problem of absorption of freight charges is this—Can I sell in a competitive market at a profit in competition with a lower freight rate?

* * * * * * *

Fundamentally I fully believe in absorbing freight rates up to the point where a normal average selling price can be attained. It is quite doubtful whether a person could state a percentage of absorption of delivered price, because that depends entirely upon how much margin there is on the commodity being sold. The price in a given market will always be established by competition, and unless a market is exceedingly unfavorably situated, it may rest assured that it is getting a price fairly close to other markets. The seller has no business to go into such a market if his margin of profits is entirely absorbed in equalizing the freight rate.

The old law of economics still operates, whether some folks think so or not, and those who are headed for the receivership scrap heap every year can frequently count their selling policy as one of the causes. A new crop of suckers is born every minute, and men will continue to give away their profits. I can, therefore, only say in summarizing that we equalize freight rates to a point where our average selling price yields us a satisfactory profit; beyond that we will not go. We keep our raw material in our own possession and keep our finished product for a better opportunity to sell and we save wear and tear on our equipment. If our profits are less, they are still profits and in our hands and available for use. Economic conditions may so change or develop that we too might be hit in eliminating profits; but it will not be because we have supplied the tonnage simply for the sake of tonnage.

* * * * * * *

In one considerable district in this industry with which I happen to be familiar, it is rather generally the practice to absorb 10c a ton freight differential on material selling at 70c a ton. This practice, although it is well understood, is still the cause of a great deal of trouble among producers. It tends to destroy a stable price situation which to my mind operates to the advantage of both the producer and the consumer.

Assuming that a stable price is advantageous to all parties, there are only two ways in which this can be obtained, and even then care must be exercised or there will be a tendency to infringe on the anti-trust laws. Prices will tend to be stabilized where the general practice is to maintain a fixed plant price. This is perhaps the most common method and in this industry is probably the only workable method, as most producers do not have the facilities to enable them to quote on a delivered price basis.

The only other method I know of, which may be used in maintaining a stable price, is that frequently followed by the cement producers in using a delivered price basis. This can be done if a producer assumes a maximum price at each mill based on known delivered prices and known freight rates and then quotes the assumed price on the lowest freight rate which applies to the particular destination in question.

Without any conspiracy on the part of producers, there is always a tendency to go to the delivered price basis rather than to maintain the fixed plant price. Where a destination is reached by several producers, if one of them does not maintain a uniform plant price with the others, it is obvious that the delivered price at that destination becomes his plant price plus his freight rate. The other producers reaching this destination may get a higher or lower plant price on their freight rates, but the delivered price has been set by the first.

With a commodity such as sand and gravel, which is a standard product, carrying very heavy charges for depreciation and interest on the investment, in comparison with the annual turn-over, there is always a tendency for the producer to overlook these costs and make his price at least temporarily based on the immediate cash costs. These temporary prices frequently become the prevailing prices. Where proper prices are maintained on this product, there always seems to be to the less experienced producer, an unnecessarily large margin of profit. A short period of years, however, will usually show that this is not the case.

From my knowledge of the industry in this immediate vicinity, I do not believe anybody is justified in a 10c freight absorption which is sometimes taken. If the producers in the territory should go to a delivered price basis, they would then be able to get an extra 10c when the freight rates were in their favor and produce a satisfactory average. Certainly 10% of the plant selling price is the outside that anyone could afford to absorb on these materials with prevailing prices.

I am inclined to think that the delivered price would be a better basis on which to do business if all of the producers thoroughly understood their freight rate situation. It would give a broader market for the individual producer and the same average net return if advantage were taken of the low freight rates as well as concessions given on the high freight rates.

* * * * * * *

As to whether or not it is good business policy to absorb freight charges is open for argument and consideration according to the other conditions. We have no rules to suggest to guide producers in this matter of absorption of freight rates, but certainly think that no business should be sold below the cost of production and marketing expense.

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My own early conception of the proper price for a manufactured article or commodity was the production cost of it plus a fair profit at its point of manufacture or production; and I have never met any well-founded argument to the contrary, even after a somewhat extensive experience in the gravel business. I have also preached this theory for many years to numerous friendly competitors who were taking the other side of the argument, which is virtually following the much criticized plan too frequently adopted by transportation carriers of "getting all the traffic will bear." I have recently had considerable satisfaction in seeing some of these "absorption" advocates coming around to the common-sense idea of selling their goods at a fair profit regardless of competitive prices at delivery points.

We cannot get away from the fact that building materials, that is, sand, gravel and crushed stone, are practically standardized, and I will venture to say that the actual cost of production among a dozen average plants will show but little variation, certainly not enough to be an item in the ordinary interpretation of absorption of freight rates, which so frequently exists between two plants and a delivery point. Given the proposition that your product is standardized, it would most naturally follow that the price should be standardized. Consequently, if a producer quotes a customer a delivered price on his material, that customer, by deducting the freight charges (which he always does) knows exactly the cost of the material at point of origin.

Perhaps the delivered price was made for a strong competitive point where other shippers had considerable advantage in freight

rate, and this producer had consequently figured on a heavy absorption on this differential in freight, but at a later time has occasion to quote the same contractor at a point of delivery advantageous to him, and he names a price which is not subject to absorption of heavy freight rates, and therefore shows a much higher price for his material at the plant. The customer is immediately dissatisfied and feels that he is being "gyped" in the price the producer is naming him. About his only recourse is to apply to some other producer who is a disciple of this absorption idea, and it frequently happens that the business is placed with a shipper who is standing for this absorption and the legitimate producer loses the business which he should have had at a fair profit. The final result is apparent, two jobs have been supplied at actual cost to the producers, or perhaps less, simply because of the absorption practice and the effect it had on the customer.

The only remedy for this condition is for the producer to name a fair price for his material at the plant and let the customer do as much or as little of this transportation absorption as he wishes. In the early days of the business, all prices were quoted f.o.b. delivery point, but at that time freight rates were not regulated by published tariffs, and the customer who settled these freight rates had very little knowledge of the actual cost of the transportation, so that the price the producer was getting for his material was more or less a mystery to the customer.

Since the passing of the Hepburn law all this manipulation is done away with, and the customer is in most cases just as familiar with the railway tariffs as the shipper. Our own company discarded the delivered price plan many years ago and has never had any cause to regret the change. It seems but natural that a gravel producer who buys practically all of his requirements at a point of origin price should sell his goods on the same basis. Aside from labor, the coal item is generally the largest expenditure around a gravel plant. The prices on coal, which is produced under somewhat similar conditions to gravel, are named f.o.b. mines.

The considerations entering this problem of rate absorption are numerous, but it is perhaps significant that the greatest amount of it is done among the newest people in the business, and I think they are actuated more by a desire to create volume of shipments, thereby kidding themselves into the belief that they are doing a large business, or in some cases being enabled to render what, in their opinion, is a better looking report to their financial backers in the enterprise.

The largest absorption cases invariably occur on long shipments, and the argument generally offered by those indulging in the practice is that their short or local shipments pay them a very good return on their production, and while these local markets will not absorb the output of the pit, it is better to ship the surplus a longer distance at a reduced price than it is to curtail the output. The lame feature of this argument is apparent, as it is only a question of time until the other shipper into the same territory also commences to absorb, with the result that prices are frequently reduced to a point which no amount of absorption can meet.

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It is difficult to define or limit a practice of absorbing freight rates or to set up hard and fast rules regarding it. My own belief is that the Golden Rule is perhaps after all the best guide for an operator in this question. It is manifestly unfair for one operator to sell at $12 and absorb $6 in freight when some other operator could supply the trade on a $2 freight rate, and if the manufacturer with the high freight rate would look at it from the standpoint of his competitor, he would not do it. The old failing that man has fallen heir to, namely, selfishness and greed, step in, however, and in many cases ruin a business that would be profitable to his fellow manufacturer without even the compensation of in anywise helping the consumer. On the other hand, there are no doubt a great many cases where an operator is entirely justified in absorbing a part of the freight rate and, where the difference is not too great, perhaps all of it. If we were going to set a percentage it would be not more than 10% of the basic plant price, and we think this is liberal.

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We feel that the difference in transportation that is absorbed should in no case exceed the difference in cost of one operation over another.

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In our estimation these practices of absorbing freight differentials from distant districts only become unethical and bad economics when a distant producer invades a district below the prevailing fair-profit-delivered prices in such a district, and on a basis substantially below the plant prices in the distant district for local shipments in that distant district. In other words, if a manufacturer in some particular territory names a price which nets him substantially less at his plant than the basis upon which he is selling for delivery to his home markets, and which price also figures out on a delivered basis in a distant territory that is less than the fair prevailing prices in that distant territory, then such a manufacturer is simply applying a dumping policy that in the long run is economically injurious to industry as a whole and decidedly unfair to competitors in adjoining territories.

Selling for Less Than Cost of Production?

Of course this question has been discussed in much of the foregoing. It seems to be a generally unanimous opinion that considerable business at less than the cost of production is unjustifiable on any grounds. Yet undoubtedly it is largely practiced in the rock products industries; and the only way to account for it is ignorance of the basic principles of business. Some quotations on this subject follow:

Selling below the cost of production certainly should not be considered by a well-regulated institution unless it is a by-product that must be sold rather than have an accumulation in warerooms or outside storage. If costs are figured correctly, this by-product should be charged off of the books and entered into the cost of the more refined products.

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We believe it is false economy to accept business that does not show a profit. If there is a shortage of material at a given point the consumer should pay the difference, just as the price varies within an immediate neighborhood of an operation based upon the difference in truck transportation, which is usually figured on the mileage basis.

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My point of view is that the producer of a basic commodity has no right to sell at a price less than the cost of production. I recognize, however, that there might conditions arise which would force the sale of the product for whatever price could be gotten.

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Freight equalization to some extent will probably always be justified, but should never be carried to a point where the net selling price, without regard to its influence on volume or other transactions, fails to produce a profit. I do not believe a deviation from this as a policy is ever justified, but one of the prime difficulties of today, as always in the past, is the fact that many producers of basic commodities neglect to assure themselves as to what the cost of production is and in response to the urge to increase volume indulge in freight absorptions that are unreasonable and unprofitable.

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We have sometimes sold a large volume, expecting to get only a small profit; but the main idea was to sell a large production and keep the cost down on the volume that we did sell. In doing this we have had to take small losses, but it was never our intention to do so. Other matters have entered in and made reductions in our profits.

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It is my judgment that no producer of a basic commodity is justified in selling a considerable quota of his production at a net plant price less than the cost of production. It may be justifiable, however, to sell a portion of production at cost price or slightly

lower than cost price in order to move an equal part of the production at a profitable price.

Establishing Season's Prices

The desirability, or feasibility, of attempting to set up a minimum plant price, to be adhered to under all conditions, seems to be a debatable question. Of course price setting and price getting are the chief gambling hazards in business. It is strange, however, that there should not be more agreement of judgment in regard to attacking the problem. Some quotations follow:

This company and other companies in which I have at times been interested in direct management have always attempted, insofar as possible, to have a basic plant price for our commodities, and we have attempted to adhere to that price in every case. There are times, however, when a competitor during a dull season will endeavor to run a plant to full capacity at the expense of his competitors by going into foreign territories and absorbing freight rates. This is a vicious practice and can only cause demoralization.

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I think it is quite desirable to have a basic plant price, but it is not always feasible. There are times when a producer is long or short on certain sizes and his storage facilities may be insufficient to take care of the surplus production of such sizes. It may therefore be necessary to cut the price on a size in order to move it. Of course, if there is a friendly relationship existing among producers, frequently through this relationship they can help each other out by buying or selling to each other, thus tending to maintain a greater price stability.

I would say that to establish an average plant price in advance of a season is really intended, but the conditions of the market are very apt to affect it so that it must be either raised or lowered according to circumstances. Of course, the more nearly prices can remain stable, business conditions generally being the same, the greater the satisfaction on the part of all concerned.

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We do not consider it feasible nor desirable to have a basic plant price, for we are dealing with approximate prices; and market situations may vary enough in adjoining districts so that plant prices might vary as much as 10 or 15% in individual cases, or as between districts, without destroying the principles that we have argued for in this statement. It has frequently happened in our case that we have shipped into distant districts, selling at about the same delivered prices as prevailing in such distant districts by the local manufacturers, but in which such material has netted us 10 or 15% more at the plant than our plant prices for local shipments in our own district. If, however, we were to knock 30 or 35% off of our normal plant prices, thereby cutting our profits to nothing, and sell to a distant district at delivered prices below the local markets in that district, we certainly should be properly condemned.

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In reference to establishment of average plant price in advance of season, we try to do this, but in our locality there is such a number of small plants starting up with the idea of getting certain business in a location where one of the states has advertised certain large construction work coming out, that we have to change prices to meet these local conditions. This we often do.

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In our opinion a good manufacturer with good business experience and a well-organized accounting department takes all possible elements into consideration compatible with his cost and the return which he is seeking on an average price realized at his mill on the investment of the stockholder. We can hardly conceive of any manufacturer within our industry that would not attempt to establish an average price as realized in advance, even during a season. How closely they can adhere to this is entirely a matter of competition, and the volume of business is certainly an important factor both in the price realized and the manufacturing cost.

We find it both feasible and desirable, in our own business, to have a basic plant price. We do establish our prices in advance, and we do usually but not always adhere to them.

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Prior to last season our entire production was always sold at a basic plant price. This price was established at the beginning of the season and rigidly adhered to. Last season, in order to meet competition from small plants and wayside pits, we were compelled to name f.o.b. prices at destination, based more or less on competitive freight rates.

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I think that it is not only feasible and desirable, but necessary, for any organization to have a definite basis of making prices, and no better basis can, in my judgment, be found than a mill price. I do not think that I have ever sensibly considered an average plant price in advance of the season. Competition controls almost entirely in this respect.

Volume as a Factor in Cost of Production

Of course the kernel of the whole problem is the firm belief in the minds of every producer that the quickest and surest way to cut costs is to increase the volume of production; and that the only way to maintain present low costs is to maintain volume production. Given a producing plant of fairly well defined capacity, and with relatively cheap raw materials, it is obvious that unit cost of production is tremendously affected by the volume of product over which the total cost is spread.

There is no question that many American industries, and particularly the rock products industries, have learned to operate at near-capacity production with an efficiency and low cost not equalled anywhere else in the world. On the other hand, there is no denying that the rock products industries need both education and experience in operating at part-capacity efficiently and economically. They have operated so long at nearly full capacity that they despair of ever operating at half capacity efficiently or profitably.

Very probably most plants in the industry are not properly designed for efficient part-capacity operation. If this is true it is a defect that eventually must be corrected, for it is inconceivable that any industry, can continue capacity production indefinitely. The steel industry, which in many respects is very similar to the portland cement industry, has learned to adjust production to demand, even with a large excess of producing capacity; to operate at times as low as half the capacity of the industry, and yet with a margin of profit. The coal industry, on the other hand, has not learned how to do it, and as a result is in a badly demoralized state.

Two fundamental principles in this problem of low-cost, big-volume production should not be overlooked: (1) The assumption that the raw materials are practically valueless is a false assumption; they may be common, but some time your competitors are going to run short; there is no excuse for giving them away, for their value is bound to increase. (2) Any amount of volume sold at cost or below cost of production will not result in profits.

The whole system by which consumers get the bene-

fit of low-cost, big-volume production, but in times of restricted production get still lower prices, designed to move the material at any cost to producers, is illogical and unsound economically. When demand slackens, production decreases and costs increase, the price to the consumer should increase correspondingly. Experience and logic both prove that he is not tempted to expand his consumption by falling prices; but that he is by stable prices or rising prices. Consumers can, and eventually must be educated to appreciate and understand the fundamental reasons for justified low prices and unjustified, unsound low prices.

Various producers view this problem of volume and costs as follows:

Volume of business is, of course, an important factor, but volume of business at the expense of a struggling competitor is not, to my mind, good business.

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In reference to the volume of the production, this is really a very important factor in the manufacturing cost. A unit can be operated to its normal capacity at considerably less than at a reduced capacity. It takes practically the same operating force and nearly the same amount of power to operate a mill at 50% capacity as it does at 100%. The same holds true of each steam shovel unit. This is the point that causes more cut-throat competition and more excuses for taking orders at less than known cost than any one condition in the business. I feel that this is often an excuse to take business away from a competitor and in many instances it is abused. It materially helps bear down the price of the entire output. It is rather a difficult proposition to sell to one customer at a cheap price and at a higher price to another concern that is just as good a customer. Again, if you sell a contractor at one price in a competitive territory, and the next job is in the immediate vicinity of the plant, he expects, practically, the competitive price.

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The importance of volume in cost is pretty well illustrated in the illustration I gave as to different factors entering into a price. If you resolve these factors into a year's volume of business and assume that a 1000-ton plant runs for 150 days it does $150,000 worth of business. In other words, it might be roughly said that in order to yield a profit of $15,000, which is involved in this line of thought, the business is based on a fixed charge of $60,000 plus the out-of-pocket cost of 60c a ton. On this theory, assuming it to be correct, the cost of producing 100,000 tons would be $60,000, which, divided by 100,000, or 60c, plus 60c of out-of-pocket cost, gives $1.20 as the necessary selling price to produce a profit of $15,000. This shows very clearly that volume of business is a very considerable factor. Of course, if business is cut down very materially there are many economies that can be effected, like cutting down the organization, but as the usual plant is now operated with a steam shovel, the out-of-pocket cost remains pretty nearly the same per day regardless of the tonnage. The only elements being in direct proportion to the production are stripping, drilling, explosives, and a small percentage of the other factors entering into the cost.

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Volume of business is an important factor in lowering cost, but probably less so than it is commonly reputed to be.

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Volume of business is an important factor in reducing costs and production as based on one grade of material, such as railway ballast. Volume of business is not so important in reducing costs when applied to a commercial product or material for highways which are in more or less intermittent demand.

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In my own personal experience, the volume of business is always important. It makes for lowered costs; it makes for greater profits. However, the lesser volume at a good price will produce more profits than capacity production at a low price. It is purely a matter of multiplication and addition, and any person conducting his business can arrive easily at the point where he is doing his work for nothing, and while making a splendid showing and keeping his plant operating, is really not doing himself or his company justice.

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Certainly volume of business is an important factor in this industry. It is a greater factor than it has the reputation of being, but close analysis has to be given a situation to determine whether or not freight absorption will actually increase the total volume of business. There is in a given territory only a certain amount of material to be delivered. Freight absorption will not increase this volume, nor do I believe that it will permanently increase the volume of the individual producer, as his competitors may soon be driven to use the same methods.

There is a common fallacy believed by many producers, and that is sometimes referred to as "volume business." Frequently producers make a price perhaps above their cash cost, but below their total costs, in order to secure volume. Without doubt this is a fallacy, and unless it is the practice of the producer to see that every bit of business taken as a general policy is above the total cost of production, the producer is headed for disaster.

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In our opinion volume of business is not as important a factor in reducing manufacturing costs as it is commonly reputed to be. Of course this answer is given assuming that the manufacturing concern has reached a size to enable it to take advantage of the best equipment available, etc.

Reaching Out After Temporary Business

Is it good business to reach out after business and absorb freight rates to excess in order to obtain temporary business you know you can't hold at current prices? It would seem there could not be two opinions on this, yet here they are:

I do not think it good business policy to absorb freight charges to excess in order to obtain business which cannot be held at current prices. In our own business we have only one rule in regard to freight charges. The management sets from time to time a minimum net price at each mill which it is willing to accept for its product. The sales organization must be guided by that rule in their solicitation of the business. That is to say, they cannot solicit in the territory where the net mill price will be less than the minimum set by the management.

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The answer to your question depends so much upon the peculiar circumstances of the case that one can hardly say whether it is good policy or not. I suppose no one would do this unless he weighed all the factors tending to dissuade him. If after giving consideration he thought it was expedient or economical, he probably would be drawn into doing it, but he must take into consideration the retaliatory spirit it engenders with his competitors, the difficulty of restoring a market to normal after it has been broken, and the general demoralization which takes place in trade under such circumstances.

What Are the Rules of the Game?

All who have read the foregoing realize that it is a case where no specific rules of practice have ever been attempted, and possibly never can be. Obviously as one executive states:

To give a definite answer to your question as to the amount of freight charges which may be justifiably absorbed in selling any commodity in a given market, you are asking a question which can be decided, in my mind, only by individual producers.

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In considering these questions one has to take into consideration as governing these decisions their legality, their expediency, their economy, their psychology, their basic justice or injustice, and their interests, giving due consideration to the interests of the purchaser, the competitor and the stockholder. I personally know of no system as fair to all concerned, under the present laws of the land, or more satisfactory than the open-price competition to which I refer, or, in other words, that which is similar to the ordinary retail merchant, who marks the price of his goods in the show window and his competitor can see exactly what it is and mark his goods down or put them up according to his individual feeling. Under such circumstances there is not necessarily any control or any expressed agreement any further than only to sell at the prices made known publicly.

I am quite sure that there is little business carried on today without an infraction of the spirit of the Sherman Act. There may not be specific agreements as to price, but there are most certainly understandings, and it is the understandings which reach the spirit to which I refer. Of course, any control of co-operation and price agreement seems illogical. In the long run supply and demand will largely cure the evil which grows out of suppressed competition, but I do believe the open-price competition is the most logical plan that has ever been adopted, although many evils can grow out of it, if not conducted on the principle which Mr. Eddy suggested.

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We believe positively, and have so believed for years, that absorption of freight rates in competition between plants is ethical as between competitors and proper economics for the general welfare of our country.

We do not believe in a distant competitor forcing delivered prices below a basis which would give a reasonable profit to the local producers in any particular district. This would certainly be both unfair and unethical unless it happened that the local producers of a district were selling without regard to their own profits and were fighting for their local market regardless of a fair price level. Of course, in the latter case any particular market is then fairly anybody's market. But where there may be enough unanimity of thought in any district by the local manufacturers as to what constitutes fair prices and the delivered markets are more or less on an even keel, we cannot see any reason why more distant competitors should not ethically offer their product at the same delivered prices.

I might sum up our broad reasons from the broader point of view of the commercial interests of the country on the following arguments:

(1) At times the consumption in a district jumps up for one reason or another and exceeds production. It is certainly against the interest of the country as a whole and particularly against the interest of our industry as a whole to have both an abnormally high price and such a shortage of supply as to encourage the use of substitutes which in time may become permanently entrenched. Why should not more distant districts, if they have a surplus in production and are willing to absorb freights, undertake shipment into the heavy demand district to preserve a better balance and protect the use of our material?

(2) At times manufacturers in certain local districts may have a temptation to agree on unnaturally high prices, which for the moment may yield them much better profits, but which in the long run is unfair to our country and is injurious to the industry as a whole for the same reasons as noted in Paragraph 1. The broad policy of absorbing freight rates with potential production from nearby districts looking for markets helps to preserve equilibrium in such cases.

(3) There are many cases where manufacturing costs in one district are so much less than the costs in an adjoining district, by reason of lower freight rates on fuel, less expensive quarrying methods and lower labor rates, that the difference in the freight rates is balanced or even in some cases more than balanced by such lower costs of production. It can certainly be argued with ethical justification as between competitors that costs should be approximately considered as including not alone the costs of production but also the costs of delivery to any particular market. Every district has its high cost and its low cost plants, and the average plane of costs is oftentimes much higher at the plants in one district than in the adjoining district. We do not see any reason in economics or ethics why the producers in an adjoining district should not ship across some theoretical border line under such conditions as these.

You ask what rules we suggest to guide producers in this matter of absorption of freight charges. We suggest one fair and basic rule, that if a manufacturer plans to ship into a distant territory and is advised as to the general delivered prices prevailing in said territory, and is further satisfied that such information is accurate and that said prices are reasonable, then such a manufacturer should certainly not sell his product below said delivered prices, otherwise he is a bad salesman and a poor business man.

Broadly speaking, we believe in the stimulation of trade by all reasonable business activity. One of the big troubles in our industry is that too few of the manufacturers have an extensive and well-trained sales force. The manufacturers throughout the country need active sales forces to conduct their work and to train the consumers to a bigger and broader use of our product, and if the policy outlined results in forcing more activity in sales work of the intelligent class that keeps these products and their many uses more intensively before the consuming public, then we feel the industry will gain in time with bigger tonnages. We therefore feel that our view and policy are constructive in behalf of the industry, as they keep the competitive districts more actively on their toes to push their markets, to secure fair prices, to make the best quality products, and in the end help the industry to its bigger opportunities.

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My personal belief is that the real solution to this and similar problems is sympathetic and intelligent co-operation through the educational medium of a dignified trade association on a horse-sense basis such as is so ably advocated by Herbert Hoover, who has the temerity to assert that "We can co-operate yet compete."

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It is my personal opinion and conviction that absorption of freight charges is price-cutting. That is to say, the two names are different names for the same thing. There are also other alternative names. One is, equalization of delivered costs or prices.

I do not believe that the cutting of prices is a practice which is in itself wrong, that is to say, dishonest, or criminal. I do think it is bad business. I think that where price-cutting is practiced, the standard of business ethics is relatively low. You will find suspicion and distrust, and you will find each man ready to accept as true information given him regarding his price-cutting competitor; that tends to lower the competitor in the estimation of the trade.

I think the practice of the Golden Rule is an excellent guide for any executive in the discharge of his duty to his concern. I think it is best there should be industrial peace. It is best for the manufacturer, and best for the direct purchaser, and best also for the ultimate consumer, which is the public. It is best in the long run that the source of supply be protected. It is best that commodities be moved under the lowest transportation cost. This is or should be the same as under the lowest freight rate.

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The only suggestion I have to offer to guide producers in the matter of absorption of freight charges is this—Do not take any business that will not show a profit.

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We do not feel like attempting a set of rules, but again we are back to our original proposition that the Golden Rule if practiced would perhaps eliminate the necessity for any others.

There is of course much more to be said, and many examples can be given showing the tremendous waste and loss resulting from the abuse of this practice. Like in many other things, it is not so destructive in theory, but it is its abuse in practice that hurts.

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No real set rule can govern the guidance of so diversified a condition as the gravel people confront, owing to various producing conditions, legal limitations, etc., but if any one rule might be observed more than another it is a very short one, namely, common

business sense! And this will keep in mind the fact that no amount of volume conducted at cost or less will show a profit at the end of the year, and that it is impossible for any concern to get a profit-carrying price for its material unless its competitor is enjoying the same privilege.

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For the benefit of those who may have forgotten, the Golden Rule is: "Do unto others as you would have them do unto you." And no law, rule or regulation can ever take the place of a man's own conscience. Many practices in business tend to dull conscience. Intercourse with fellow competitors in both local and national associations tends to broaden and liberalize a man's outlook and his appreciation of the other fellow's problems and of his right to live, thus eventually quickening his conscience. It is not enough that we make a profit today, tomorrow, or this year. We must look ahead and see whether our actions are going to yield a profit, one year, five years, or ten years hence, and whether we are engaged in an industry to be proud of, or one to be ashamed of.

Sunday Quarrying in Merry Old England

AT the Caernarvon county police court, before A. Wynne Williams and other magistrates, eight men were summoned for a breach of the Sunday Observance Act of 1677 at Waenfawr. The defendants worked at the Dudley Park quarry, Waenfawr. The managing director of the quarry, B. S. Johnson, was also charged with aiding and abetting.

Superintendent Williams prosecuted and W. R. Hughes appeared for the defendants.

P. C. Henderson, Waenfawr, said that about 2:20 p.m. on March 6 he heard sounds of blasting at the Dudley Park quarry, Waenfawr, and he proceeded there immediately. He saw three of the defendants working, laying down some air pipes. Witness spoke to one of them and asked him who had given him instructions to work, and he replied that it was the manager. Witness then met a boy 15 years old, and asked who had been blasting, and the boy replied that it was Mr. Johnson. Witness told him that he had heard two reports and the boy replied that they had been blasting four or five times that day. Witness added that he saw the other defendants, who were clearing the way. He added that there might be about 20 or 30 working at the quarry.

After evidence, W. R. Hughes asked if there was a case to answer. The act stated that "no tradesman, workman, laborer or any other person over 14 years of age should do or exercise any worldly labor, business or work of his ordinary calling upon the Lord's Day, work of necessity or charity excepted." The superintendent, however, had left the words "ordinary calling" out of the summons. This was a 17th century act passed so that the public would be prevented from following work of their ordinary calling on the Sabbath. But were the magistrates in the 20th century going to give their blessing to the act when eight men out of 80 were asked by Mr. Johnson would they agree to do a special job. They were not compelled to do it, but if they did not it would mean that some of the men would be idle the following week. The men thus agreed to work, and, as the officer said, the men were laying air pipes. The officer had also said that some people in Waenfawr had previously complained to him. Mr. Johnson was a practical mining engineer with a wide experience, and if the police officer had called at his office first he would have explained everything to him and he would have said he was sorry. When the officer came on the scene the men at once stopped work, as they were not under compulsion.

The Bench decided to fine five of the defendants 5s. each, and the summonses against the other three were dismissed.

Mr. Johnson was fined 5s. in each of the first five cases.—*The Quarry Managers' Journal.*

Fair and Unfair Competition

HISTORY has established that commercial intercourse between nations and individuals is provocative of enmity if it gives rise to grievances. Conversely, commerce which is conducted under equitable conditions and with just treatment of all concerned is productive of enduring satisfaction.

In the history of the law the principle of commercial morality is a comparably recent development. The last century has witnessed a gradual departure from the false attitude of dealing at arm's length. Business men have come to realize that sound trade is built on confidence and good faith and not on suspicion and cunning. Legislators and courts have recognized the necessity of strict measures for the enforcement of fair and honest methods of commerce. The compelling influence of public policy has molded and shaped the doctrines of fair trade and unfair competition.

Leaning toward the picturesque, the popular mind represents competition as war and trade as conquest. This aphorism cannot be uttered without a qualification. Competition is economic warfare, but warfare that must be conducted under conditions fair to all participants. The conquest belongs of right to him who merits it.

From the viewpoint of national welfare and public policy it is incontrovertible that an adequate law dealing with unfair competition in trade is necessary. Among the acts which should be especially prohibited are those recognized at the Brussels Congress of the International Chamber of Commerce as particularly repugnant to legitimate trade. These acts are enumerated as follows:

(1) False indications regarding the origin, type, nature or special characteristics of products.

(2) Use of false awards of merit and false certificates or testimonials.

(3) Acts calculated to create confusion with regard to the person, the establishment or the products of competitors.

(4) Disparagement of the person, establishment or goods of competitors.

(5) Enticement of employes and procurement of breach of law and contract.—Bernard A. Kosiciki, in U. S. Commerce Reports.

President Coolidge Urged to Raise Tariff on Plate and Window Glass

PRODUCERS of glass sand will be interested to know that President Coolidge was urged on May 2 to invoke the flexible provisions of the tariff act for a 50% increase in the duties on importations of plate glass and window glass to meet foreign competition.

The request was made by Senator David A. Reed, of Pennsylvania, who called at the White House to explain to the president what he described as the "terrible condition of the plate glass and window glass industry in the United States and particularly in western Pennsylvania."

"A number of plate glass and window glass companies have already failed because of inability to meet foreign competition from Belgium and Czechoslovakia," said Senator Reed. "A great many of them have suspended their dividends, and complete shutdowns in plants are imminent.

"The Belgium and Czechoslovakia glass factories have been delivering glass in the United States for less than the cost of production in America. The whole condition is due not to any superiority in their process of manufacture, but to the fact that wages in those countries are about one-fourth of the American wage scale."

The Tariff Commission now is making an investigation of the competition in the plate glass industry, Senator Reed said, "and I thought to impress upon the president the gravity of the situation, in the hope that it would speed up the investigation." The difference in cost in manufacture of plate glass here and abroad would justify far more than a 50% increase, the senator added.

Financial News and Comment

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

(These are the most recent quotations available at this printing. Revisions, corrections and supplemental information will be welcomed by the editor.)

Stock	Date	Par	Price bid	Price asked	Dividend rate
Allentown Portland Cement Co. (common)[32]	May 24	.....	1½	3	
Allentown Portland Cement Co. (6% bonds, 1932)[32]	May 24	.....	87	92	
Alpha Portland Cement Co. (common)[2] new stock	June 21	No par	40	42	37½c quar. Apr. 15
Alpha Portland Cement Co. (preferred)[2]	June 21	100	115	.....	1¾% quar. June 15
American Lime and Stone Co. (7% bonds, 1942)[32]	May 24	.....	97	101	
Arundel Corporation (sand and gravel—new stock)	June 20	No par	35½	35½	50c April 1
Atlantic Gypsum Products Corp. (1st 6's carrying 10 sh. com.)[10]	June 8	.....	117	120	
Atlas Portland Cement Co. (common)[2]	June 21	No par	43	43	50c qu. March 1
Atlas Portland Cement Co. (preferred)	.....	100	.....	.....	2% quar. Oct. 1
Atlas Portland Cement Co. (preferred)[2]	June 21	33⅓	43	.....	2% quar. Apr. 1
Beaver Portland Cement Co. (1st Mort. 7's)[8]	July 29	100	100	100	
Bessemer Limestone and Cement Co. (Class A)[4]	Apr. 8	.....	34	34¾	75c quar. May 1
Bessemer Limestone and Cement Co. (6½% bonds)[4]	Apr. 8	.....	99	100	
Boston Sand and Gravel Co. (common)	June 18	100	72	.....	1% qu., 2% ex. Jan. 1
Boston Sand and Gravel Co. (preferred)	June 20	.....	.....	85	1¾% quar. Jan. 1
Boston Sand and Gravel Co. (1st preferred)	June 20	.....	.....	90	2% quar. Jan. 1
Canada Cement Co., Ltd. (common)	June 20	100	147	148	1½% qu. July 16
Canada Cement Co., Ltd. (preferred)[11]	June 18	100	119	120	1¾% quar. May 16
Canada Cement Co., Ltd. (1st 6's, 1929)[11]	Jnue 18	.....	101	102	3% semi-annual A&O
Canada Crushed Stone Corp., Ltd. (6½s, 1944)[11]	June 18	100	95	99	
Charles Warner Co. (lime, crushed stone, sand and gravel)	June 19	No par	25	.....	50c Apr. 11
Charles Warner Co. (preferred)	June 19	100	105	.....	1¾% quar. Apr. 28
Charles Warner Co. (lime, crushed stone, sand and gravel) 7s, 1929[16]	June 18	100	102	.....	
Cleveland Stone Co. (new stock)	June 21	.....	60	63	50c qu. June 15
Connecticut Quarries Co. (1st Mortgage 7% bonds)[17]	June 18	100	105	.....	
Consolidated Cement Corp. (1st Mort., 6½s, series A)[24]	June 22	100	97	99	
Consolidated Cement Corp. (5 yr. 6½% gold notes)[24]	June 22	100	95	100	
Consumers Rock and Gravel Co. (1st Mort. 7s)[18]	June 18	100	99½	101½	
Coosa Portland Cement Co. (6% bonds, 1944)[32]	May 24	.....	70	.....	
Coplay Portland Cement Co. (6% bonds, 1941)[32]	May 24	.....	88	.....	
Dewey Portland Cement Co. (1st mort. 6's 1942)[30]	June 22	100	99	.....	
Dolese and Shepard Co. (crushed stone)[7]	June 20	50	94	97	$1.50 July 1, $1 ex. July 1
Egyptian Portland Cement Co. 7% pfd.[21]	June 18	.....	80	90	1¾% quar. Oct. 1
Egyptian Portland Cement Co. (common)[21]	June 18	.....	5	7	40c quar. Oct. 1
Fredonia Portland Cement Co. (6½% bonds, 1940)[32]	May 24	.....	97	101	
Giant Portland Cement Co. (common)[2]	June 21	50	50	65	
Giant Portland Cement Co. (preferred)[25]	June 21	50	40	46	3½% June 15
Ideal Cement Co. (common)	June 20	No par	83	84	$1 quar., $1 ex. Dec. 15
Ideal Cement Co. (preferred)[33]	June 20	100	109½	111½	1¾% quar. Dec. 15
International Cement Corporation (common)	June 20	No par	57¾	58	$1 quar. June 30
International Cement Corporation (preferred)[2]	June 8	100	109⅛	109½	1¾% quar. June 30
Kelley Island Lime and Transport Co.	June 21	100	138	140	$2 quar. July 1
Lawrence Portland Cement Co.[2]	June 19	100	99	102	2% quar.
Lehigh Portland Cement Co.[6]	June 19	50	105	110	1½% quar.
Lyman Richey Sand and Gravel Co. (1st Mort. 6s, 1928 to 1931)[13]	May 21	100	98	100	
Lyman Richey Sand and Gravel Co. (1st Mort. 6s, 1932 to 1935)[13]	May 21	100	96½	99	
Marblehead Lime Co. (1st Mort. 7's)[14]	June 17	100	100	.....	
Marblehead Lime Co. (5½% notes)[14]	June 17	100	98	.....	
Michigan Limestone and Chemical Co. (common)[6]	June 19	.....	26	28	
Michigan Limestone and Chemical Co. (preferred)[6]	June 19	.....	24	26	1¾% quar. July 15
Missouri Portland Cement Co.	June 20	25	42¾	42¾	50c May 1
Monolith Portland Cement Co. (common)[9]	June 18	.....	12½	13	8% ann. Jan. 2
Monolith Portland Cement Co. (units)[9]	June 18	.....	31	32½	
Monolith Portland Cement Co. (preferred)[9]	June 18	.....	9¼	9¾	
National Gypsum Co. (common)[35]	June 22	.....	64½	65½	
National Gypsum Co. (preferred)[35]	June 22	.....	83	86	
Nazareth Cement Co.[20]	June 18	No par	30	32	75c quar. Apr. 1
Newaygo Portland Cement Co.[1]	June 17	.....	110	115	
Newaygo Portland Cement Co. (6½% bonds, 1938)[32]	May 24	.....	100	102	
New England Lime Co. (Series A, preferred)[14]	June 17	100	.....	95	
New England Lime Co. (Series B, preferred)[22]	June 21	100	95	97	
New England Lime Co. (V.T.C.)[22]	June 21	.....	33	36	
New England Lime Co. (6s, 1935)[14]	June 17	100	99	101	
New York Trap Rock Corp. (6% bonds, 1946)[32]	June 20	.....	98	98¼	
North American Cement Corp. 6½s 1940 (with warrants)	June 20	100	90½	91	
North American Cement Corp. (units of 1 sh. pfd. plus ½ sh. common)[32]	Apr. 26	.....	62	67	2 mo. period at rate of 7%
North American Cement Corp. (common)[19]	Apr. 9	.....	8⅛	9	
North American Cement Corp. (preferred)	Apr. 25	.....	.....	.....	1.75 quar. May 2
North Shore Material Co. (1st Mort. 6's)[15]	June 22	100	98½	100	
Pacific Portland Cement Co., Consolidated[5]	June 19	100	61¾	74	25c mo.
Pacific Portland Cement Co., Consolidated (secured serial gold notes)[5]	June 19	100	97½	.....	3% semi-annual Oct. 15
Peerless Portland Cement Co.[1]	June 17	10	4⅞	5¼	
Pennsylvania-Dixie Cement Corp. (1st Mort. 6's)[29]	June 20	100	100	100½	
Pennsylvania-Dixie Cement Corp. (preferred)[28]	June 22	100	99	.....	1¾% June 15
Pennsylvania-Dixie Cement Corp. (common)[28]	June 20	.....	33	33	80c July 1
Petoskey Portland Cement Co.[1]	June 20	10	10½	11¼	1½% quar.
Pittsfield Lime and Stone Co.[31]	Apr. 26	.....	.....	100	
Pittsfield Lime and Stone Co.[31] (common)	Feb. 25	.....	.....	25	

(CONTINUED ON PAGE 79)

[1]Quotations by Watling,Lerchen & Hayes Co., Detroit, Mich. [2]Quotations by Bristol & Willett, New York. [3]Quotations by True, Webber & Co., Chicago. [4]Quotations by Butler, Beading & Co., Youngstown, Ohio. [5]Quotations by Freeman, Smith & Camp Co., San Francisco, Calif. [6]Quotations by Frederic H. Hatch & Co., New York. [7]Quotations by F. M. Zeiler & Co., Chicago, Ill. [8]Quotations by Ralph Schneeloch Co., Portland, Ore. [9]Quotations by A. E. White Co., San Francisco, Calif. [10]Quotations by Lee Higginson & Co., Boston and Chicago. [11]Nesbitt, Thomson & Co., Montreal, Canada. [12]E. B. Merritt & Co., Inc., Bridgeport, Conn. [13]Peters Trust Co., Omaha, Neb. [14]Second Ward Securities Co., Milwaukee, Wis. [15]Central Trust Co. of Illinois, Chicago. [16]J. S. Wilson, Jr., Co., Baltimore, Md. [17]Chas. W. Scranton & Co., New Haven, Conn. [18]Dean, Witter & Co., Los Angeles, Calif. [19]Hemphill, Noyes & Co., New York. [20]Quotations by Bond & Goodwin & Tucker, Inc., San Francisco. [21]Baker, Simonds & Co., Inc., New York. [22]William C. Simons, Inc., Springfield, Mass. [23]Blair & Co., New York and Chicago. [24]A. B. Leach and Co., Inc., Chicago. [25]A. C. Richards & Co., Philadelphia, Penn. [26]Hincks Bros. & Co., Bridgeport, Conn. [27]J. G. White and Co., New York. [28]Mitchell-Hutchins Co., Chicago, Ill. [29]National City Co., Chicago, Ill. [30]Chicago Trust Co., Chicago. [31]McIntyre & Co., New York, N. Y. [32]Hepburn & Co., New York. [33]Boettcher & Co., Denver, Colo. [34]Kidder, Peabody & Co., Boston, Mass. [35]Farnum, Winter and Co., Chicago. [36]Hanson and Hanson, New York.

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS (Continued)

Stock	Date	Par	Price bid	Price asked	Dividend Rate
Riverside Portland Cement Co.	May 9	.....	165	.....	
Rockland and Rockport Lime Corp. (1st preferred)[34]	June 20	100	103	.....	3½% semi-annual Feb. 1
Rockland and Rockport Lime Corp. (2nd preferred)[34]	June 20	100	60	.....	3% semi-annual Feb. 1
Rockland and Rockport Lime Corp. (common)[34]	June 20	No par	50	55	1½% quar. Nov. 2
Sandusky Cement Co. (common)[1]	June 21	100	110	125	$2 qu. April 1
Santa Cruz Portland Cement Co. (bonds)[8]	June 19	.....	106	107	6% annual
Santa Cruz Portland Cement Co. (common)[8]	June 19	.....	85	90	$1 quar., $1 ex. Jan. 1
Schumacher Wallboard Corp. (common)	June 19	.....	24¾	25½	
Schumacher Wallboard Corp. (preferred)	June 19	.....	25½	25⅞	
Southwestern Portland Cement Co. (units)	May 11	.....	205	.....	
Superior Portland Cement, Inc. (Class A)[30]	June 18	.....	44¾	45	
Superior Portland Cement, Inc. (Class B)[30]	June 18	.....	22½	.....	
United Fuel and Supply Co. (sand and gravel) 1st Mort. 6s[27]	June 3	100	98	100	
United Fuel and Supply Co. (sand and gravel) 6% gold notes[27]	June 3	100	98	100	
United States Gypsum Co. (common)	June 20	20	95¼	96¾	40c quar. June 30
United States Gypsum Co. (preferred)	June 20	100	122	122	1¾% quar. June 30
Universal Gypsum Co. (common)[3]	June 20	No par	7	.....	
Universal Gypsum V.T.C.[3]	June 20	No par	5	6	
Universal Gypsum Co. (preferred)[3]	Nov. 23	.....	73	77	1½% Feb. 15
Universal Gypsum and Lime Co. (1st 6's, 1946)[3]	June 20	100	.....	96	
Union Rock Co. (7% serial gold bonds)[18]	June 18	.....	99	101	
Upper Hudson Stone Co. (1st 6's, 1951)[32]	May 24	.....	93	.....	
Upper Hudson Stone Co. (1st 6's, 1937)[32]	May 24	.....	104	.....	
Vulcanite Portland Cement Co. (7½% bonds, 1943)[32]	May 24	100	98½	101	
Whitehall Cement Mfg. Co. (common)[30]	June 17	.....	98	.....	
Wisconsin Lime and Cement Co. (1st Mort. 6s, 1940)[15]	June 22	100	99	101	
Wolverine Portland Cement Co.	June 20	10	6¾	7½	15c quar. May 16
Yosemite Portland Cement Co.	May 11	.....	7½	.....	

QUOTATIONS OF INACTIVE ROCK PRODUCTS SECURITIES

Stock	Date	Par	Price bid	Price asked	Dividend rate
Atlanta Shope Brick and Tile Co.[1]	Nov. 24	.....	25c	.....	
Benedict Stone Corp. (cast-stone) (50 sh. pfd. and 390 sh. com.)[1]	Dec. 29	.....	$400 for the lot	.....	
Blue Stone Quarry (60 shares)[2]	Mar. 16	.....	$10¼ for the lot	.....	
Coplay Cement Mfg. Co. (common) (4)	Dec. 16	.....	12½	.....	
Coplay Cement Mfg. Co. (preferred) (1)	Dec. 30	.....	70	.....	
Eastern Brick Corp. (7% cu. pfd.) (1)	Dec. 9	10	40c	.....	
Eastern Brick Corp. (sand lime brick) (common) (1)	Dec. 9	10	40c	.....	
Edison Portland Cement Co. (common)[4]	Sept. 11	50	20c	.....	
Edison Portland Cement Co. (preferred)	Nov. 3	50	17½c(x)	.....	
International Portland Cement Co., Ltd. (preferred)	Mar. 1	.....	30	45	
Globe Phosphate Co. ($10,000 1st mtg. bonds, $169.80 per $1000 paid on prin.)	Dec. 22	.....	$50 for the lot	.....	
Iroquois Sand and Gravel Co., Ltd. (2 sh. com. and 3 sh. pfd.) (1)	Mar. 17	.....	$12 for the lot	.....	
Limestone Products Corp. (150 sh. pfd., $50 par, and 150 sh. com., no par)	Dec. 22	.....	$60 for the lot	.....	
Missouri Portland Cement Co. (serial bonds)	Dec. 31	.....	104¾	104¾	3¼% semi-annual
Olympic Portland Cement Co. (g)	Oct. 13	.....	.....	£1⅜	
Phosphate Mining Co. (1)	Nov. 24	.....	1	.....	
River Feldspar and Milling Co. (50 sh. com. and 50 sh. pfd.) (1)	June 23	.....	$200 for the lot		
Rockport Granite Co. (1st 6's, 1934)[2]	Aug. 31	.....	90	.....	
Simbroco Stone Co.[2]	Apr. 20	.....	12	12	
Southern Phosphate Corp.[6]	Sept. 15	.....	1¼	.....	
Tidewater Portland Cement Co. (3000 sh. com.)	Dec. 22	.....	$6525 for the lot	.....	
Vermont Milling Products Co. (slate granules) 22 sh. com. and 12 sh. pfd. (5)	Nov. 3	.....	$1 for the lot	.....	
Wabash Portland Cement Co.[1]	Aug. 3	50	60	100	
Winchester Brick Co. (preferred) (sand lime brick) (5)	Dec. 16	.....	10c	.....	

(g) Neidecker and Co., Ltd., London, England. (1) Price obtained at auction by Adrian H. Muller & Sons, New York. (2) Price obtained at auction by R. L. Day and Co., Boston. (3) Price obtained at auction by Weilepp-Bruton and Co., Baltimore, Md. (4) Price obtained at auction by Barnes and Lofland, Philadelphia, Pa. (5) Price obtained at auction for lot of 50 shar es by R. L. Day and Co., Boston, Mass. (x) Price obtained at auction by Barnes and Lofland, Philadelphia, on November 3, 1925. (6) Price obtained a t auction by Wise, Hobbs and Arnold, Boston, Mass.

Cement Producers' Profits Fall Off

RECENT issues of the *Wall Street Journal*, the *Christian Science Monitor*, and other newspapers in the East have carried financial news under the above caption, or something similar, evidently originating at the same source. The following is an entire article as published in the *Wall Street Journal:*

Earnings of the portland cement industry are expected to be somewhat lower this year than in the immediate past, even though production may exceed that of the banner year of 1926, when output aggregated 164,057,000 bbl. While some of the larger concerns will show good profits, many of the smaller producers will find it more difficult to report satisfactory returns as a result of the recent cutting of cement prices in the territory east of the Mississippi River.

The two chief factors which have brought about this situation are the competition among manufacturers and the dumping of output by European mills on the Atlantic seaboard.

Of the two developings, the latter has had the most damaging effect. It has brought about losses to manufacturers in some coast cities where prices were reduced in an effort to maintain a foothold; in other coast cities, where the mills are nearer the market and freight rates less, cement is sold at only a nominal profit.

In 1923 European shipments became a serious factor in the American markets, imports in that year totaling 1,678,686 bbl. By 1925 they reached the peak of 3,655,316 bbl., declining to 3,250,056 bbl. in 1926. The tendency is still downward, as for the first two months of this year imports amounted to 323,596 bbl. compared with 671,698 bbl. in the corresponding period of 1926. While imports of 3,200,000 bbl. would seem to be insignificant compared with a total domestic production of 164,000,000 bbl., they become important when dumped into a restricted territory, causing domestic mills built to serve those sections to seek other markets, to meet prices of the European product or to curtail production. In the quest of other markets the American producer must invade sections already well supplied, with the effect that the situation becomes aggravated as the condition spreads and causes additional competition.

New England Particularly Affected

Although foreign cement has entered in quantity along the Atlantic seaboard, conditions in New England particularly have been affected. Last year 703,215 bbl. of foreign cement were brought into that district, compared with 6,700,000 bbl. shipped in by domestic producers, the latter being produced in about equal quantities by Lehigh Valley and Hudson Valley mills. However, the greater part of the foreign cement was dumped at Boston, causing American producers to reduce prices as much as 50c a barrel, in some cases since January 1, last. A cut of 30c a barrel was made on January 3 and was followed by a further reduction of 20c on large contracts late in April. The latter cut netted Hudson Valley mills $1.45 a barrel, the difference between that figure and the selling price in Boston of $2.43 being made up of 58c for freight and 40c for sacks, the latter charge being refunded with the return of the sacks.

The first cut of 30c, intended only for Boston, had the effect of causing a reduction of 20c in the Hudson Valley, which in turn was reflected in a general slashing of prices in all territory east of the Mississippi.

American producers are at a distinct disadvantage in that, under the law, they cannot co-operate to repel the foreign invader. On the other hand, European producers are encouraged by their respective governments in the formation of cartels with consequent allotment of tonnages in various American markets.

The ability of the European to injure the American producer can be fully visualized in the case of New Orleans, where the nearest producing district is located at Birmingham, Ala. The cost of shipments from there to New Orleans is 72c a barrel, which compares with freight charges of 40c a barrel from Europe. Foreign vessels engaged in the carrying of cargoes from New Orleans to Europe return to the port practically empty and are willing to take cement as ballast with a minimum freight rate.

Again, where the wage of the American cement worker is $4.50 a day, similar labor can be obtained abroad for 90c.

It is estimated that Belgium supplies 74% of the total American importation, the bulk of the remainder of imports coming from Great Britain, Denmark, Sweden and Norway. During the past four years Belgium has made great strides in building up its cement industry, production having been almost doubled in that period.

Surplus of Domestic Mills

The great expansion in the productive capacity of the United States has been a disquieting factor to manufacturers. While the various mills make claims to capacities that would give the country a theoretical output of 215,000,000 bbl., it is estimated that practical capacity is about 200,000,000 bbl. In addition, 22 mills are being built or projected with a combined potential ontput of 20,000,000 bbl., half of which capacity will come into bearing by the close of the current year. Shipments last year were 161,781,000 bbl., constituting a new high record, being 5,057,000 bbl. higher than in 1925. In 1926 production exceeded shipments by 2,276,000 bbl., bringing stocks in the hands of producers on January 1, last, to 20,616,000 bbl., a new peak.

Since 1902 the industry has been active in finding new uses for its product and has expanded utilization to a marked degree. A large part of cement output goes into road building, requirements for 1926 having been in excess of 40,000,000 bbl. The cement road is comparatively recent. In 1903 there were only three miles of cement concrete highway in the United States. The total at the close of 1926 was 47,000 miles.

Another important outlet has been the tremendous building program that has been carried on for the past several years. The use of cement in construction operations has been growing steadily at the expense of other materials, such as brick, lumber and stone, and it is the continued widening of such outlets that must be encouraged if the demand is to be kept within striking distance of production.

An idea of how rapid has been the growth of the cement industry can be visualized by a comparison of the production increase during the past 26 years of the Universal Portland Cement Co., a subsidiary of the United States Steel Corp. and one of the largest producers in the country. Last year Universal's output totaled 14,526,000 bbl. as compared with 11,960,000 bbl. in 1920, 7,001,500 bbl. in 1910, 1,735,343 bbl. in 1905 and 261,712 bbl. in 1901. Since the formation of the U. S. Steel Corp. in 1901 its cement subsidiary has produced a total of 206,222,407 bbl.

Following table gives cement production and shipments since 1911, as well as stocks on hand at the close of each year:

	Production	Shipments	Stocks in hands of producers
1926	164,057,000	161,781,000	20,616,000
1925	161,202,000	156,724,000	18,515,000
1924	148,859,000	145,747,000	13,913,000
1923	137,460,238	135,912,118	10,575,000
1922	114,789,984	117,701,216	9,108,000
1921	98,842,049	95,507,147	11,938,000
1920	100,023,245	96,311,719	8,290,000
1919	80,777,935	85,612,899	5,842,831
1918	71,081,663	70,915,508	10,451,044
1917	92,814,202	90,703,474	10,353,838
1916	91,521,198	94,552,296	8,360,552
1915	85,914,907	86,891,681	11,462,523
1914	88,230,170	86,437,956	12,773,463
1913	92,097,131	88,689,377	11,220,328
1912	82,438,096	85,012,556	7,811,329
1911	78,528,637	75,547,829	10,385,789

Wolverine Portland Cement Co.

THE Wolverine Portland Cement Co. dates from February 24, 1902, when it was incorporated under the laws of Michigan. The manufacture and sale of portland cement comprise the activities of the concern. Its plants are located at Coldwater and Quincy, Mich. They have a combined daily capacity of 2500 bbl.

The company has no funded debt. Capital stock consists of $1,000,000, all outstanding in shares of the par value of $10 each. Dividends have been paid with some interruptions since 1902 at rates ranging as high as 26%, the latter rate being disbursed in 1907. After a lapse from 1918 to 1922, 3% was paid in 1923, 16% in 1924, 60 cents in 1925 and 30 cents in 1926. February 15 and May 16, 1927, a distribution of 15 cents a share was made.

The stock is listed on the Chicago Exchange. The five-year record follows:

Year	High		Low
1922	Jan.,	3¼	Aug., 2
1923	July,	6	Jan., 2¾
1924	Sept.,	13¼	Jan., 5⅞
1925	Feb.,	13¼	Aug., 6¼
1926	May,	9⅞	Sept., 5¾
1927	Feb.,	5⅞	Mar., 5¼

For the year ended December 31, 1926, net sales totaled $7,706,791 and net income was $12,038, leaving a deficit after dividends of $17,862. This with other minor items reduced profit and loss surplus from $210,519 December 31, 1925, to $192,557 a year later. As of January 1, 1927, net current assets totaled $582,890 and current liabilities $20,586, leaving a net working capital of $562,304. As of December 31, 1926, balance sheet the indicated book value, including $37,668 fire insurance reserve, applicable to the 100,000 shares of capital stock, amounted to $1,230,013, or $12.30 per share.—*Charlestown* (S. C.) *Post.*

English Cement Producers in Merger

IN a circular recently issued to shareholders, the directors of the Ship Canal Portland Cement Manufacturers, Ltd., announced that negotiations had been concluded whereby the company had acquired, in conjunction with other important interests, the business of "one of the best known cement manufacturers in the country." The name of the business was not disclosed, but it is reported in the market to be that of Greaves, Bull & Lakin, Ltd., of Leamington, England.

At the beginning of the year, in connection with important developments then pending, the directors accepted an offer from an influental group for the unissued balance of the company's preference shares, amounting to 88,361 shares, at par, or 15s. per share, stipulating, however, that one-third of these shares were to be reserved for existing shareholders at this price. Presumably the new acquisition has been financed on the lines indicated, and it is confidently anticipated by the directors of the Ship Canal Portland Cement Manufacturers that their participation in the business will prove a valuable and profitable asset.—*The Quarry and Surveyors and Contractors Journal* (England).

National Cement of Canada Elects Officers

FOLLOWING the retirement of Joseph Versailles as president and director of the National Cement Co., Montreal, Que., Donat Raymond, vice-president of the company, was elected president. The vacancy on the board was filled by the appointment of J. R. Lefebvre, who is also the general manager. Senator J. M. Wilson has become vice-president.

The full board of directors as at present constituted is as follows: Hon. Donat Raymond, president; Hon. J. M. Wilson, vice-president; Hon. George A. Simard, L. H. Timmins, J. R. Lefebvre and R. K. Meade.

In a recent statement, Mr. Raymond emphatically denied all rumors that American interests were seeking control of the company. He stated that absolute control was obtained by himself, Senator Wilson and Mr. Timmins in September, 1925. Since then these interests have retained every share they then acquired. They did not relinquish, directly or indirectly, any part of their holdings. On the contrary, they increased them, Mr. Raymond says.

Charles Warner 7's Called

ALL of the outstanding series A 7% five-year sinking fund convertable gold bonds, dated April 1, 1924, have been called for payment July 1 next at 102 and interest at the Wilmington Trust Co., Wilmington, Del.

Southern Phosphate Earnings

THE following are the comparative earnings of the Southern Phosphate Corp. for the years 1923 to 1926, inclusive:

SOUTHERN PHOSPHATE CORP. EARNINGS, 1923-26

Calendar Years:	1926	1925	1924	1923
Gross profit	$174,918	$ 38,521	$207,013	$141,776
General and administrative expenses	42,822	52,689	47,931	61,843
Net earnings	$132,096	*$14,167	$159,082	$ 79,933
Other income	14,514	15,250	9,591	7,451
Total income	$146,610	$ 1,083	$168,673	$ 87,384
Interest, capital stock tax, etc.	36,787	44,478	20,964	29,365
Shutdown expenses	11,811	19,253	25,113	29,733
Depreciation, depletion, obsolescence & surplus adjustment	218,512	193,900	204,799	195,147
Balance, deficit	$120,501	$256,548	$ 82,203	$166,861

*Loss.

John F. Pollock Honored by Associates and Employes

JOHN F. POLLOCK, vice-president and treasurer of the Ash Grove Lime and Portland Cement Co., Kansas City, Mo., was accorded an unusual tribute recently by those associated with him in the general offices of the Ash Grove company.

Known and respected throughout the building material industry, and by hundreds of dealers over the entire Middle West, Mr. Pollock also represents a distinct exception to the old adage that "no man is a hero to his valet." For his closest associates, those with whom he comes in contact every day, hold him in the highest esteem. This regard for him is by no means limited to the employes and dealers, for at the recent National Lime Association convention, Mr. Pollock was elected one of the five regional vice-presidents.

Unsuspectingly, he recently divulged the information that he was soon to celebrate his thirty-fifth wedding anniversary. Immediately some office sleuth ascertained the exact date and the word was passed around quietly. On that morning he entered his office to find a deluge of beautiful, fragrant flowers and a hearty congratulatory note signed personally by every member of the general offices, from the president to the office boy. It was truly a sincere expression of admiration prompted by a feeling of high respect. Coming from his closest associates in the business world, it was indeed a tribute to his own lovable personality and sterling character.

John F. Pollock

United Electric Limestone Co. Buys East St. Louis Plant

THE United Electric Limestone Co., a subsidiary of the United Electric Coal Co. of New York City and Danville, Ill., has purchased the East St. Louis Stone Co., East St. Louis, Ill., from Ralph E. McLean. Fred C. Murphy is vice-president and sales manager of the United Electric Limestone Co., and Ralph E. McLean, former manager of the East St. Louis Stone Co., remains as manager of production of the United Electric Limestone Co.

The quarry and plant of the East St. Louis Stone Co. was described in ROCK PRODUCTS, May 15, 1926. The following is an extract from that article:

"One of the oldest, continuously operated quarries in the St. Louis district is that of the East St. Louis Stone Co., East St. Louis, Ill., on the Mississippi river opposite St. Louis, Mo. For the past 23 years it has been operated under the direction of Ralph E. McLean, and for 30 years prior to that by the firm of Niemes & Riemann, for rubble building stone. Mr. McLean, who began his quarry experience as a bookkeeper for the original firm, is now the sole owner of the enterprise."

E. Struckmann Named Superintendent of International Cement

ACCORDING to recent announcement, Edwin Struckmann, former superintendent of the Hudson N. Y. plant of the Knickerbocker Portland Cement Co., has been named general superintendent of the eastern plants of the International Cement corporation, of which the Knickerbocker company is a subsidiary. Mr. Struckmann will maintain offices in Albany at 100 State street in conjunction with the office of the Knickerbocker company.

In outlining the reasons for the establishing of headquarters of the general superintendent in Albany, Mr. Struckmann said that the steady growth of construction requirements in the northeastern part of the United States, a territory in which Albany is an important focal point, necessitated the the move.

New Quick Hardening Cement Demonstrated by Ash Grove Co.

TO demonstrate the quick-hardening properties of its new cement, "Quickard," the Ash Grove Lime and Portland Cement Co. has made arrangements for its use in the paving of a section of a street in Chanute, Kas., where its mill is located. The section measures 30 ft. in width and 150 ft. in length. The pavement is to be 6-in. concrete and the contractors will use a mixture of one part "Quickard" cement, two parts sand and three and one-half parts rock. F. W. Austin, city engineer, and Guy O. Gardner, local superintendent for the Ash Grove company, will assist the contractors in supervising the laying of the concrete.

Mayor B. F. Baughman and Commissioners H. E. Coulter and Parks Helmick will personally witness the demonstration, as will high officials of the Ash Grove company, the Sante Fe Railroad and others interested in the building field. In addition, the entire Ash Grove sales organization, including representatives from all parts of the Middle West, will be in Chanute.

W. E. Farrell on British Quarry Convention Program

W. E. FARRELL, president of the Easton Car and Construction Co., Easton, Penn., is on the program of the annual convention of the Institution of Quarry Managers of Great Britain, at Harrogate, Wednesday, June 29. The subject of Mr. Farrell's paper is "Rolling Stock in Quarries."

Mr. Farrell during the past year completed arrangements with the Cambrian Wagon Co., Ltd., Cardiff, Wales, for the manufacture in Great Britain of his patented types of quarry cars. The "Phoenix" all-steel car, so well known in this country, is being especially featured at the machinery and equipment exhibt held in connection with the Quarry Managers' convention.

At these conventions full-size equipment is exhibited in tents, or in the open This exhibt should prove especially interesting to Mr. Farrell, who is a founder member and a past president of the National Crushed Stone Association, and had much to do with the development of the exhibit feature at the annual conventions of the American quarry managers.

Cement Merger Off

OFFICIALS of Lehigh Portland Cement Co. and International Cement Corp. state that negotiations which have been held looking toward a merger of the two properties have been discontinued, says a recent report in the *New York* (N. Y.) *Journal of Commerce.*

Portland Cement Output in May

Production Greatest for Any May—Shipments Decrease Over Last Year — Stocks Still High

PRODUCTION of portland cement is the greatest in any May, and shipments have been exceeded only in one other—May, 1926, according to the Bureau of Mines, Department of Commerce. Portland cement stocks show a slight decrease but are still high and are 10% in excess of the stocks at the end of May, 1926.

The output of two more new plants, located respectively in Tennessee and West Virginia, is included for the first time in these statistics, which are prepared by the Division of Mineral Resources and Statistics of the Bureau of Mines and are compiled from reports for May, 1927, received direct from all manufacturing plants except two, for which estimates are necessary on account of lack of returns.

Clinker Stocks

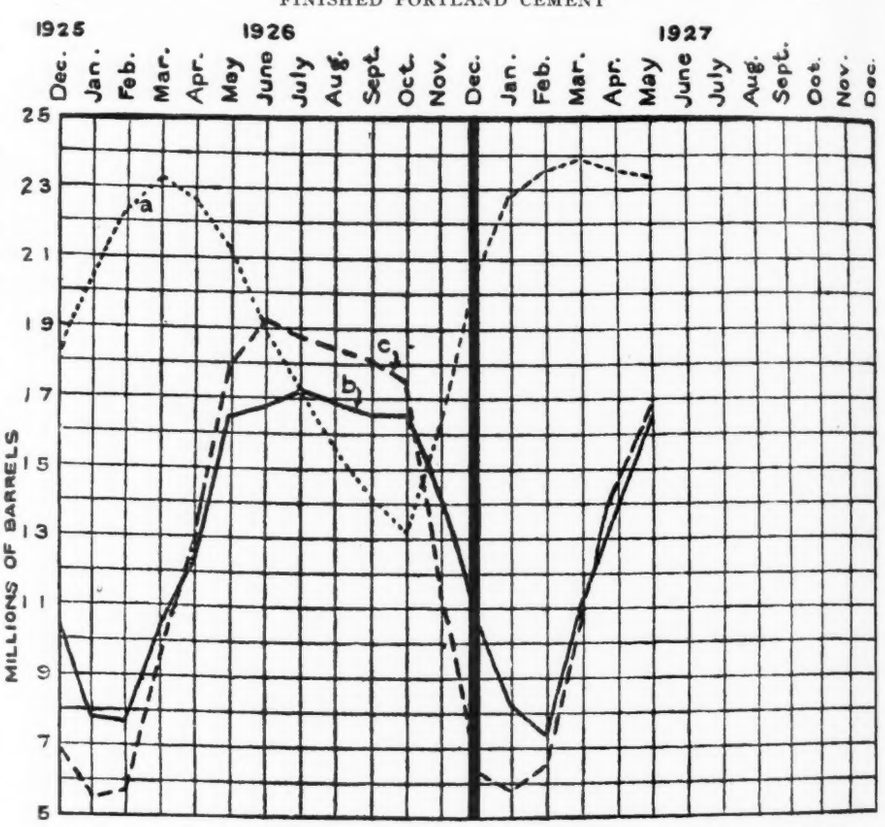
Stocks of clinker, or unground cement, at the mills at the end of May, 1927, amounted to about 12,492,000 bbl. compared with 13,335,000 bbl. (revised) at the beginning of the month.

ESTIMATED CLINKER (UNGROUND CEMENT) AT THE MILLS AT END OF EACH MONTH, 1926 AND 1927, IN BARRELS

Month	1926	1927
January	9,074,000	9,989,000
February	10,931,000	11,943,000
March	12,290,000	12,997,000
April	12,967,000	*13,335,000
May	11,695,000	12,492,000
June	10,144,000	
July	8,604,000	
August	7,362,000	
September	6,112,000	
October	5,370,000	
November	5,748,000	
December	7,799,000	

*Revised.

MONTHLY FLUCTUATION IN PRODUCTION, SHIPMENTS AND STOCKS OF FINISHED PORTLAND CEMENT



(a) Stocks of finished portland cement at factories. (b) Production of finished portland cement. (c) Shipments of finished portland cement from factories

Distribution of Cement

The following figures show shipments from portland cement mills distributed among the states to which cement was shipped during the months of March and April, 1926 and 1927:

PORTLAND CEMENT SHIPPED FROM MILLS INTO STATES IN MARCH AND APRIL, 1926 AND 1927, IN BARRELS*

Shipped to	1926—March	1927	1926—April	1927
Alabama	158,310	141,921	215,372	173,893
Alaska	917	305	957	1,037
Arizona	54,916	45,602	40,257	47,573
Arkansas	66,712	59,114	62,646	53,331
California	1,156,509	1,094,778	850,124	1,137,845
Colorado	81,623	47,912	104,386	86,431
Connecticut	78,962	109,035	149,459	179,863
Delaware	22,386	24,826	48,259	40,699
District of Columbia	63,249	95,396	82,579	89,048
Florida	402,888	290,682	323,909	271,575
Georgia	139,781	169,167	171,829	168,681
Hawaii	24,737	19,615	27,999	25,876
Idaho	42,131	35,047	47,688	32,063
Illinois	570,121	752,148	†961,612	956,012
Indiana	190,063	267,288	†310,301	411,087
Iowa	116,367	147,119	219,716	211,243
Kansas	182,003	166,110	204,165	203,368
Kentucky	88,790	111,854	†141,326	144,791
Louisiana	96,214	134,893	99,889	107,023
Maine	18,302	20,132	33,345	39,031
Maryland	132,720	231,780	199,076	224,405
Massachusetts	168,271	193,283	298,326	293,606
Michigan	396,643	525,901	†576,865	854,042
Minnesota	164,405	147,967	296,040	258,506
Mississippi	58,308	75,149	65,511	78,127
Missouri	332,104	287,825	505,850	312,311
Montana	17,203	19,365	23,063	23,882
Nebraska	121,456	81,860	170,591	96,255
Nevada	8,824	7,665	8,478	10,406
New Hampshire	18,043	25,391	37,909	43,932
New Jersey	424,812	611,542	†653,779	897,645
New Mexico	18,594	32,564	† 15,861	28,566
New York	1,026,903	1,511,091	†1,633,864	2,131,528
North Carolina	271,422	235,316	357,978	324,758
North Dakota	23,260	20,429	39,039	38,157
Ohio	420,536	576,334	†674,151	851,619
Oklahoma	206,766	235,301	220,016	242,747
Oregon	117,611	91,820	126,874	122,281
Pennsylvania	745,395	864,996	†1,243,762	1,200,019
Porto Rico	0	2,500	0	1,000
Rhode Island	34,838	50,746	64,303	78,743
South Carolina	69,811	71,247	49,573	82,680
South Dakota	38,194	31,724	43,693	35,465
Tennessee	117,610	137,431	178,683	180,574
Texas	367,833	481,261	411,203	472,879
Utah	37,117	25,741	35,218	31,793
Vermont	5,052	9,397	14,358	30,185
Virginia	121,765	124,387	161,284	135,226
Washington	152,534	229,012	189,037	248,518
West Virginia	89,108	97,058	†154,310	112,065
Wisconsin	155,840	221,345	†277,248	356,961
Wyoming	12,225	10,293	13,887	14,783
Unspecified	37,724	16,486	† 57,493	102,398
	9,467,908	11,017,151	†12,893,141	14,296,532
Foreign countries	71,092	65,849	71,859	53,468
Total shipped from cement plants	9,539,000	11,083,000	12,965,000	14,350,000

*Includes estimated distribution of shipments from four plants in April, 1926, and from five plants in March, 1926, and in March and April, 1927.
†Revised.

PRODUCTION, SHIPMENTS AND STOCKS OF FINISHED PORTLAND CEMENT, BY MONTHS, IN 1926 AND 1927

Month	Production 1926	Production 1927	Shipments 1926	Shipments 1927	Stocks at end of month 1926	Stocks at end of month 1927
January	7,887,000	8,258,000	5,674,000	5,968,000	20,582,000	22,914,000
February	7,731,000	7,377,000	5,820,000	6,731,000	22,385,000	23,560,000
March	10,390,000	11,452,000	9,539,000	11,083,000	23,236,000	23,922,000
First quarter	26,008,000	27,087,000	21,033,000	23,782,000	.....	.....
April	12,440,000	14,048,000	12,965,000	14,350,000	22,710,000	*23,654,000
May	16,510,000	16,674,000	17,973,000	16,857,000	21,255,000	23,471,000
June	16,866,000	.....	19,134,000	.....	19,000,000	.....
Second quarter	45,816,000	.....	50,072,000	.....	.....	.....
July	17,134,000	.....	18,812,000	.....	17,301,000	.....
August	16,995,000	.....	18,583,000	.....	15,718,000	.....
September	16,571,000	.....	18,087,000	.....	14,188,000	.....
Third quarter	50,700,000	.....	55,482,000	.....	.....	.....
October	16,596,000	.....	17,486,000	.....	13,334,000	.....
November	14,193,000	.....	11,276,000	.....	16,243,000	.....
December	10,744,000	.....	6,432,000	.....	20,616,000	.....
Fourth quarter	41,533,000	.....	35,194,000	.....	.....	.....
	164,057,000	.....	161,781,000	.....	.....	.....

*Revised.

PRODUCTION, SHIPMENTS AND STOCKS OF FINISHED PORTLAND CEMENT, BY DISTRICTS, IN MAY, 1926 AND 1927, AND STOCKS IN APRIL, 1927, IN BARRELS

Commercial district	Production 1926—May—1927		Shipments 1926—May—1927		Stocks at end of 1926—May—1927		Stocks at end of Apr. 1927*
E. Penn., N.J. & Md...	3,939,000	4,040,000	4,620,000	4,139,000	4,629,000	5,055,000	5,154,000
New York	861,000	1,006,000	928,000	956,000	1,418,000	1,673,000	1,624,000
Ohio, W.Penn., W.Va.	1,825,000	1,558,000	1,921,000	1,538,000	2,697,000	3,400,000	3,380,000
Michigan	1,290,000	1,558,000	1,301,000	1,431,000	1,915,000	2,195,000	2,068,000
Wis., Ill., Ind., Ky.....	2,238,000	2,189,000	2,598,000	2,336,000	3,456,000	1,130,000	3,277,000
Va., Tenn., Ala., Ga...	1,428,000	1,456,000	1,420,000	1,453,000	*1,068,000	1,146,000	1,144,000
E'n Mo., Iowa, Minn. and So. Dak.....	1,518,000	1,440,000	1,777,000	1,382,000	2,819,000	3,289,000	3,231,000
W'n Mo., Neb., Kan. and Okla.	1,116,000	1,037,000	1,131,000	1,070,000	1,430,000	1,723,000	1,756,000
Texas	454,000	462,000	447,000	573,000	515,000	314,000	425,000
Colo., Mont. & Utah..	273,000	246,000	256,000	227,000	347,000	506,000	486,000
California	1,233,000	1,364,000	1,259,000	1,423,000	526,000	570,000	629,000
Oregon and Wash.....	335,000	318,000	315,000	329,000	435,000	470,000	480,000
	16,510,000	16,674,000	17,973,000	16,857,000	21,255,000	23,471,000	23,654,000

*Revised.

IMPORTS OF HYDRAULIC CEMENT BY COUNTRIES AND BY DISTRICTS, IN APRIL, 1927

Imported from	District into which imported	Barrels	Value
Belgium	Me. & N. H.	15,050	$19,975
	Massachusetts	50,432	96,475
	New Orleans	9,544	12,438
	New York	50	84
	Philadelphia	26,433	38,255
	Porto Rico	5,000	9,205
	Rhode Island	16,757	23,059
	San Francisco	6,000	7,529
	South Carolina	4,007	7,669
	Washington	100	237
	Total	133,373	$214,926
Canada	Saint Lawrence	1,500	$4,218
Denmark and Faroe Islands	Porto Rico	33,482	$47,364
France	New Orleans	316	$1,606
	New York	50	605
	Total	366	$2,211
Norway	Philadelphia	5,000	$6,340
Turkey in Europe	New Orleans	500	$1,049
	Philadelphia	647	1,526
	Porto Rico	17,000	35,628
	Total	18,147	$38,203
	Grand total	191,868	$313,262

EXPORTS AND IMPORTS* EXPORTS OF HYDRAULIC CEMENT BY COUNTRIES, IN APRIL, 1927

Exported to	Barrels	Value
Canada	1,777	$8,027
Central America	11,582	29,940
Cuba	10,880	28,789
Other West Indies and Bermuda	5,065	12,109
Mexico	8,911	29,133
South America	27,141	98,257
Other countries	7,027	37,577
	72,383	$243,832

DOMESTIC HYDRAULIC CEMENT SHIPPED TO ALASKA, HAWAII AND PORTO RICO IN APRIL, 1927*

	Barrels	Value
Alaska	2,698	$ 8,146
Hawaii	19,517	48,971
Porto Rico	10,101	23,481
	32,316	$80,598

*Compiled from the records of the Bureau of Foreign and Domestic Commerce and subject to revision.

EXPORTS AND IMPORTS OF HYDRAULIC CEMENT, BY MONTHS, IN 1926 AND 1927

Month	Exports 1926 Barrels	Exports 1926 Value	Exports 1927 Barrels	Exports 1927 Value	Imports 1926 Barrels	Imports 1926 Value	Imports 1927 Barrels	Imports 1927 Value
January	72,939	$216,431	75,346	$254,072	360,580	$576,717	193,175	$269,661
February	73,975	220,706	71,404	233,985	314,118	527,948	130,421	200,680
March	69,080	205,647	67,956	240,165	493,241	812,968	181,145	261,519
April	96,296	284,772	72,383	243,832	257,302	398,114	191,868	313,262
May	78,601	224,365	.....	.....	223,130	337,031	.....	.....
June	80,684	248,814	.....	.....	335,570	495,744	.....	.....
July	130,822	370,220	.....	.....	250,862	395,981	.....	.....
August	64,946	216,489	.....	.....	350,638	560,532	.....	.....
September	70,920	239,174	.....	.....	194,129	308,224	.....	.....
October	69,389	225,874	.....	.....	263,403	386,335	.....	.....
November	76,598	238,103	.....	.....	55,233	82,949	.....	.....
December	89,976	305,238	.....	.....	151,850	246,293	.....	.....
	974,226	$2,995,833	.....	.....	3,250,056	$5,128,836	.....	.....

The Battle of the Bags

WE have noted occasionally the red-hot controversy in the South over the use of paper sacks vs. cotton sacks for shipping cement. It has gone so far that some state legislatures or other authorities insist that all cement used for public work, at least, be shipped in cotton sacks. It is another example of the interesting battle of politics vs. economic law. The situation is made more complicated for our Southern friends by a correspondent of the *Manufacturer's Record*—a leading exponent of the cotton sack—who points out that kraft paper, of which the paper sacks are made, is a Southern product, as well as cotton. Such are ever the difficulties of those who would settle problems of economics by act of the legislature! The letter of the correspondent follows:

New Orleans, La., June 8.

Editor, Manufacturers' Record:

V. H. Kriegshaber's article in the *Building Supply News* of May 3, advocating cotton sacks instead of paper, as quoted and favorably commented on in your issue of June 2, gives incorrect conclusions because it overlooks some of the facts.

It is true that cotton sacks "are rebated at 10c each" *when returned,* and consequently, *considering this credit,* cement packed in them costs 15c per barrel less than when packed in paper, but whoever heard of sacks being returned 100%, and who with practical experience does not know of the losses from carelessness, stealing and injury? And if more than one sack of the four misses credit there is a loss in buying in cotton sacks instead of a gain.

In addition, what about the time it takes to collect, pack and ship the cotton sacks which are returned? What about the susceptibility of the contents to damage by water in the cotton sack over the multiple-wall paper sack, which has four thicknesses of 40 lb. and one thickness of 50 lb. paper? What about the saving of time in getting out the contents of the paper sack?

The multiple-wall kraft paper sack is the coming package, not only for cement and hydrated lime, but for a multitude of other products, such as flour, sugar, coffee, rice, etc. It is strong, dustproof, water-resisting, low-priced. It is growing in favor daily. I saw a letter not long ago from the official in charge of packing of one of the largest cement companies in this country, in which he stated that he considered it the best package ever devised for cement.

Kraft paper is just as good a Southern product as cotton; I see no reason why you should advocate one over the other.

C. E. Dobson, Secretary.

Russian Potash Deposits

THE head of engineering operations on the newly discovered potash deposits in Solikamsk, Russia, is reported to have returned to Moscow and to have stated that nine deep test borings have been completed. The surface so far involved is 100 square kilometers. Construction has been begun south of Solikamsk on the first works to go into operation probably in the beginning of 1928. Other pioneer work is being done in the Bereznikov district, the first drilling having been made in March. The potash deposits are believed to be centered under a surface 40 kilometers long and 10 kilometers wide between Solikamsk and Bereznikov, a tract of 400 square kilometers.—Trade Commission William T. Daugherty, Berlin, *in U. S. Commerce Reports.*

Foreign Abstracts and Patent Review

High-Test Belgian Portland Cement. The production of high-test portland cement has been re-established in Belgium, the product being designated by the trade name "Ceberit." The tensile and compressive strength of a 1:3 mix with sand not specified appears to be: at 1 day—24.7 and 268 kg. per sq. cm. (350 and 3800 lb. per sq. in.) respectively; at 3 days—36.3 and 419 kg. per sq. cm. (515 and 5950 lb. per sq. in.); at 7 days—42.0 and 671 kg. per sq. cm. (600 and 9520 lb. per sq. in.; at 28 days—51.3 and 693 kg. per sq. cm. (730 and 9900 lb. per sq. in.). The method of curing is not indicated, although the values of strength of portland cement quoted for comparison are: at 28 days—31 kg. per sq. cm. and 430 kg. per sq. cm. (440 and 6100 lb. per sq. in.) respectively. — *Tonindustrie-Zeitung* (1927), **35,** 624.

Accelerated Cement Burning Process. An oxygen carrier, such as ferric oxide, is added to the pulverized raw cement materials to facilitate the fuel combustion. A desirable proportion is sufficient ferric oxide to make about 1/12 of the lime content of the raw materials. *H. Kühl, Austrian Patent No.* 104,148.

Restricted Rotary Cement Kiln. One or more restrictions are provided in a rotary cement kiln, to form a sintering zone and condensing chamber into which the fuel inlet pipe penetrates. Rotation speed of the kiln is governed by the greatest internal diameter of the calcining zone. Lower coal consumption and lower waste gas temperatures are claimed for the process. *M. Büttner, German Patent No.* 435,077.

Rotary Kiln With Heat Exchanger. Heat exchanger of metal is placed in the preheating zone of a rotary cement kiln. The exchanger is provided with radial plates at the periphery which spread the slurry in thin sheets over a central tube or series of tubes through which hot gases pass. The inner wall of the calcining zone has projections for spreading the material along horizontal planes, through which the progress is impeded and kiln capacity increased. The rotary cooler is equipped in a similar manner. Only sufficient air to maintain combustion is admitted in the kiln. *O. Bouzin, British Patent No.* 266,939.

Preheating Slurry. The slurry inlet pipe is placed to pass through the flue gas chamber where it is heated by the waste kiln gases. An outer jacket surrounding the inlet pipe is for conduction of the waste gases and also to prevent heat taken up by slurry from being lost during its passage to the kiln. *G. Polysius, German Patent No.* 435,792.

Cement Admixtures. Variable proportions of iron or aluminum hydrate are added to hydraulic cements to combine with the free lime on setting and thus prevent efflorescence and accelerate the aging. *A. E. Hills, British Patent No.* 266,775.

Cellular Gypsum Compounds. Calcium carbonate is added to plaster of paris and the mixture treated with dilute hydrochloric or other mineral acid (the amount of acid added being from 40 to 60% by weight of the mix). The mixture is then cast into molds having porous tops and made waterproof by adding a facing of cement or concrete or by previous addition of ferric or magnesium sulphate to the mixture. *G. O. Case, British Patent No.* 266,524.

Gypsum Plastic. Dry plaster of paris is mixed with a liquid-fiber mixture the fibers of which are saturated with liqiud to form a paste through which the fibers are distributed. The paste is then shaped as desired and permitted to harden. *J. F. Haggerty, Canadian Patent No.* 267,422.

Gypsum Wallboard. Stucco made by mixing dry plaster of paris with an aqueous solution containing about 2% by weight of beaten and comminuted wood fiber is shaped into board form. *J. F. Haggerty, Canadian Patent No.* 267,423.

Artificial Marble. An artificial marble comprising a mixture of one part waterproof cement, two parts washed and graded sand to which is added a solution containing 40 gal. of water 4 lb. of sodium silicate and 2. lb. boric acid, sufficient solution being added to make a plastic mass. The surface is wet at various intervals during curing. *J. J. Burke, Canadian Patent No.* 268,160.

Lightweight Artificial Stone. A composition of 32 parts of portland cement, 16 parts gypsum, 96 parts of cinders, 32 parts water and 1 part calcium chloride. *A. Pepin, Canadian Patent No.* 268,308.

Effect of Calcination Temperature on Rate of Solution of Lime. Professor P. Budnikoff, Charkow, U. S. S. R., studied the rate of solution of lime calcined at different temperatures and the effect of certain admixtures on the rate of solution. The method used was based on determinations of electric conductivity. The material used was a calcium oxalate by Kahlbaum calcined in an electric furnace at temperatures of 600, 700, 800, 930, 1000, 1200, 1400, 1700 deg. C. during a period of two hours. An oxy-acetylene flame and an electric arc furnace were also used. The time was reduced to ½ hour in the latter tests. The determination of electric conductivity was made in a 300-cc. glass container at 20 deg. C. The container was provided with a thermometer and an electrically driven agitator. Conductivity was measured under thorough agitation of the mass (3000 r.p.m.). The container was tightly sealed to eliminate the effect of CO_2.

Electric conductivity depends on the quantities of Ca and OH ions. The higher the conductivity, the more thorough is the hydration and, consequently, the solution of lime. Therefore, conductivity is an indication of the rate of solution. The curves showed a maximum rate of solution for a lime calcined at 1100 deg. C., the maximum of conductivity being reached in 5 min. The rate of solution of lime calcined at 800 deg. C. corresponded to 9 min.; 930 deg. C. to 8 min.; 1200 deg. C. to 9 min. and 1400 deg. C. to 15 min. The solution process was very slow for lime calcined at 1700 deg. C. in an electric arc.

Further tests were made to determine the rate of solution of natural lime calcined at the same temperatures as the chemically pure lime of the first series of tests. The values showed that the conductivity of a calcined natural lime is lower than that of chemically pure lime. Maximum rate of solution took place in 12 min. with a lime calcined at 1100 deg. C.

The rate of solution of regenerated (repeatedly hydrated and calcined lime) lime was also determined. The results showed little effect of repeated burning on the rate of solution.

Silica was added to calcium oxalate in amounts of 2.5, 10 and 20% and its effect was studied. The mixture was calcined at 1100 deg. C. for a period of two hours. The tests showed a decrease of conductivity for high percentages of silica admixture.

The following conclusions were drawn:

The maximum rate of solution takes place with a lime calcined at 1100 deg. C. Increased temperature reduces the rate of solution, although inappreciably.

The rate of solution of regenerated lime calcined at 1100 deg. C. is somewhat lower than that of lime calcined at the same temperature.

The composition of the material used has a marked effect on the rate of solution. Thus, a lime, which is the product of a limestone containing admixtures of SiO_2, MgO, Al_2O_3, Fe_2O_3, etc., dissolves more slowly than a chemically pure lime, calcined at the same temperatures.

Further tests should determine the possible colloidal state of $Ca(OH)_2$ in the solution of CaO calcined at different temperatures. These tests are made by means of the Ostwald viscosimeter with a simultaneous determination of conductivity. The rate of solution of MgO is determined in the same manner. *Tonindustrie-Zeitung* (1927), **42,** 739.

Recent Process Patents

The following brief abstracts are of current process patents issued by the U. S. Patent Office, Washington, D. C. Complete copies may be obtained by sending 10c to the Superintendent of Documents, Government Printing Office, Washington, for each patent desired.

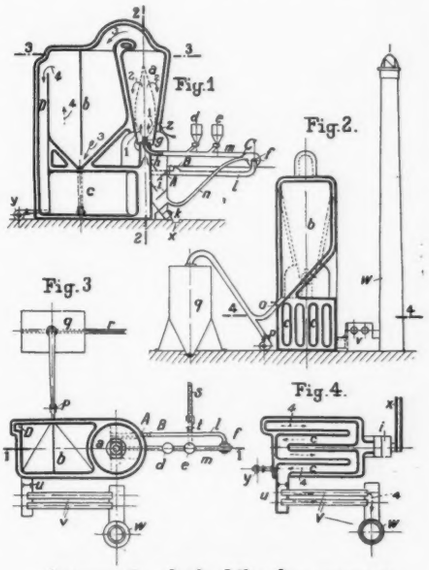
Automatic Shaft Kiln with Dust Collecting and Waste Heat Recovery System for Burning of Cement. The accompanying sketch shows vertical and horizontal sections through a kiln which is intended to improve the efficiency and increase the output of shaft cement kilns. With reference to Fig. 1:

The shaft of the kiln is indicated at *a*, and *b* is the dust chamber communicating with the heating channels *c*, *c* extending back and forth, as shown, *d* and *e* are the containers for coal dust and crude meal of the material respectively, *f* is a high pressure fan or blower; *g* is the burning nozzle, *h* is a short tube for the admission of the preheated air of combustion into the calcining shaft, *i* are chutes along which the burnt material is adapted to slide down into the delivery device *k*. Then, *l* is the suction pipe, *m* and *n* are the pressure tubes of the fan or blower *f*; *o* is a self-acting valve or damper, *p* is another blower or fan, *q* indicates another dust chamber, *r* and *s* are two conveyor screws, *t* is a dredger or the like, *u* is a closing slide, *v* are two drying drums for the crude material, *w* is the chimney, *x* is a conveyor chute for the burnt or calcined material, *y* is a low pressure fan or blower, and *z* is the fresh air damper or valve.

The members *a*, *b* and *c* are jacketed. Between the two walls there is a space for the circulation of the air of combustion. The air enters through the adjustable valve or damper *z* by the action of the chimney; it flows through the space between the walls and is thereby highly heated. The air is finally delivered through the tubing *h* into the calcining shaft *a*. The preheating of the air is carried on continuously in this manner and always remains uniform with a given size of heating surface and a given amount of fuel admission. Coal dust, oil or gas and crude meal of material are injected from below into the shaft *a* through the nozzle *g* and by means of the blower *f*, while a small portion of the air of combustion is sucked in by means of the pipe conduit *l*. In order to control the quantity and temperature of the air to be aspirated the slide A and the fresh air valve or damper B are provided.

The mode of operation of the apparatus is substantially as follows:

The particles of material (arrows 1) having been carried up and calcined by the flame have thereby acquired a higher specific gravity and drop down along the walls of the shaft *a* (arrows 2) and proceed by way of the chutes *i* to the delivery device, or gate *k*, adapted to prevent the entrance of outer air into the shaft. The particles of calcined material drop from the gate *k* into a shaking chute or channel *x* or into a similar device whence they are carried away for further treatment. The particles of material, however, which have not been completely calcined are carried by the suction of the chimney into the dust chamber *b* (arrows 3) where they drop to the bottom, and become accumulated until their weight is sufficient to open the valve or closure *o* sufficiently to allow them of being acted upon by the fan or blower *p* by means of which they are blown into the second dust chamber *q*. In this chamber they are caused to settle, preferably by electric means, and are collected and are continuously conducted to the crude meal container *e* by the conveyor screws *r*, *s* and the dredger *t*, and may then be burnt over again. By this means it is not only possible to avoid all losses of dust of material, but there is the further advantage that the finest particles of dust can be agglomerated.



Automatic shaft kiln for cement manufacture

For the purpose of recovering the waste heat of the finished product a pressure pipe *n* is branched off from the pressure pipe *m*, said branch pipe *n* being adapted to lead an adjustable fraction of the air of combustion sucked in by the pipe *l*, through the glowing and completely calcined particles and to extract the excess of heat therefrom. This highly heated portion of the air passes under the combined aspirating action of the chimney and of the nozzle into the shaft *a*. The regulation is effected by means of the damper or valve C.

The gases of combustion pass according to the arrows 4 from the dust chamber *b* through the connecting tube D into the system of channels *c;* in case they should still be of a temperature exceeding the temperature necessary for keeping up the chimney draft, the gases, as appears from the drawing, may be led through the drums *v* where the crude material is dried.

The entire arrangement of kiln with accessories operates in a perfectly automatic manner, after it has been once adjusted for a certain quantity of fuel found by experience to be the proper amount, and with substantially unchanging size of flame and degrees of temperature of the heat of combustion. The kiln or furnace may also be provided with inclined shafts instead of with a vertical shaft. *Carl Naske, U. S. No.* 1,622,337.

Plastic Cement Stuccos. A plastic material for interior and exterior plastering whose essential ingredients are portland cement, kaolin and finely divided hydrated lime. The preferred proportions are 88 parts of cement, 6 parts of kaolin and 6 parts of hydrated lime, all by weight. The amounts of clay and lime added depend upon the mortar strength and plasticity desired. *H. E. Brookby* (assignor to U. S. Gypsum Co.), *U. S. Patent No.* 1,627,952.

Shaft Lime Kiln With Controlled Waste Gas Recirculation System. A vertical shaft kiln is provided with external furnaces in which fuel such as oil or pulverized coal is burnt. An exhaust fan at the top of the kiln draws the hot gases up and through the limestone in the kiln and also acts as a recirculating fan to withdraw the waste gases from the top of the kiln and deliver them to the furnace between the point where combustion takes place and where combustion products are delivered to the kiln. In this way the gases dilute the relatively hot combustion gases which up to this time have a temperature in excess of that required for efficient limestone decomposition. *Arthur E. Truesdell, U. S. Patent No.* 1,627,215.

Treatment of Raw Materials in Rotary Cement Kiln. In a rotary cement kiln, the slurry is passed in as usual and the nodules formed upon drying in the preheating zone crushed within the kiln by a suitable arrangement and the reduced dried material then allowed to pass to the calcination and clinkering zones. The crushing is for the purpose increasing the kiln efficiency and the quality of the finished clinker, for the greater surface produced in the drying zone facilitates the calcining and increases homogeneity of the raw material. *M. Vogel-Jorgensen, U. S. Patent No.* 1,627,585.

Non-Sintered Slag Cement. Granulated slag produced by dropping molten slag into cold water is mixed with a variable content of limestone or lime and about 2% by weight of gypsum. The lime or limestone addition is guided by the silica content of the slag. The assembled materials are passed through a rotary dryer and thoroughly dried, after which a percentage of portland cement—portland cement clinker or cement is added and the mixture ground in mills to a point where 80% pass through 200 mesh. The amounts of cement, clinker, etc., range up to 13% of the total. The preferred percentages of materials are variable amounts of limestone or lime to which are added upwards of 70% undried granulated slag, 3% or thereabouts of gypsum and approximately from 5 to 10% of cement or cement clinker. *J. G. Harding, U. S. Patent No.* 1,627,237.

Traffic and Transportation

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Car Loadings of Sand and Gravel, Stone and Limestone Flux

THE following are the weekly car loadings of sand and gravel, crushed stone and limestone flux (by railroad districts), as reported by the Car Service Division, American Railway Association, Washington, D. C.:

CAR LOADINGS OF SAND, GRAVEL, STONE AND LIMESTONE FLUX

	Limestone Flux Week ended		Sand, Gravel and Stone Week ended	
District	May 14	May 21	May 14	May 21
Eastern	3,600	3,779	14,535	14,660
Allegheny	3,903	3,562	9,861	9,921
Pocahontas	751	717	1,075	1,023
Southern	496	696	13,056	12,749
Northwestern	2,088	1,837	8,722	9,415
Central Western	647	617	11,531	12,244
Southwestern	301	295	6,758	6,634
Total	11,786	11,503	65,538	66,646

COMPARATIVE TOTAL LOADINGS, BY DISTRICTS, 1926 AND 1927

	Limestone Flux Period to Date		Sand, Gravel and Stone Period to Date	
	May 22	May 21	May 22	May 21
Eastern	57,592	66,570	91,886	105,945
Allegheny	72,325	70,077	88,006	103,031
Pocahontas	7,179	7,162	13,050	12,128
Southern	13,701	10,596	211,120	220,129
Northwestern	22,093	24,670	69,395	86,183
Central Western	9,463	9,732	143,516	144,744
Southwestern	4,534	6,069	88,167	94,774
Total	186,887	194,876	705,140	766,934

Comparative Total Loadings 1926 and 1927

	1926	1927
Limestone flux	*186,887*	*194,876*
and, stone and gravel	*705,140*	*766,934*

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week beginning June 19:

SOUTHERN FREIGHT ASSOCIATION DOCKET

34397. **Stone, crushed** or broken, from Harriman, Tenn., to L. & N. R. R. stations. At present the Southern Ry. operates commodity rates on crushed or broken stone, carloads, from Harriman, Tenn., to Oliver Springs, Marlow, Dosset, Knoxville, Coal Creek, Vasper, Jacksboro, La Follette, Holton, Highcliff, Tenn., Lot, Ky., and L. & N. R. R.-Southern Ry. point track stations on the Clear Fork Branch, Holton, Tenn., to Fone, Ky., inclusive, while via the route of the L. & N. R. R. to these same points, lowest combinations apply. It is proposed to place the route of the L. & N. R. R. on a parity with that of the Southern Ry. by establishing rates on—Stone, crushed or broken, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity actual weight will apply—from Harriman, Tenn., to all of the foregoing points, except to Holton, Tenn., made the same as rates applicable via Southern Ry. To Holton, Tenn., Fourth Section observance necessitates rate of 99c, the same as to High Cliff, Tenn., the next station beyond Holton. It is further proposed to observe as maximum at intermediate local stations on the L. & N. R. R. the rates proposed to the junction points. To Khotan and Windrock, Tenn., L. & N. R. R. local stations beyond Oliver Springs, Tenn., it is proposed to establish a rate of 63c per net ton, made with relation to the rates proposed herein to other L. & N. R. R. stations, distance considered.

34401. **Crushed stone** from Anna, Ill., Cedar Bluff and Cerulean, Ky., to B. & N. W. Ry. stations. Class rates now apply. Proposed rates on—Stone, crushed, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, in which case the actual weight shall apply, carloads, from origins mentioned to B. & N. W. Ry. stations, 124c per net ton, same as in effect from Newsom and Mimms, Tenn., quarry points on the N. C. & St. L. Ry.

34446. **Crushed stone** from Hellams, S. C., to Augusta, Ga. Present rate, 139c per net ton. Proposed rate on—Stone, crushed, carloads, minimum weight 90% of the marked capacity of car, except that when car is loaded to full visible capacity actual weight shall govern—from Hellams, S. C., to Augusta, Ga., 135c per net ton, made by use of the joint standard line scale prescribed by the Interstate Commerce Commission in Docket 17517.

34488. **Gravel** from Montgomery, Ala., to La Grange, Ga. Present rate, 90c per net ton. In view of the Interstate Commerce Commission's order to vacate and set aside in Docket 13365, it is proposed to increase the rate on gravel, carloads, from Montgomery, Ala., to La Grange, Ga., to 110c per net ton. The proposed rate is made on basis of the mileage scale set forth in I. C. C. Docket 17517.

34599. **Sand, gravel,** chert and similar commodities, from, to and between all points on the L. & N. R. R. It is proposed to revise the present rates on sand, gravel, chert, slag, crushed stone, crushed slate, rubble stone and ballast (crushed stone), carloads, from, to and between all points on the L. & N. R. R. on basis of the scale prescribed by the Interstate Commerce Commission in Docket 17517. Statement of present and proposed rates between representative points will be furnished upon request.

34632. **Sand,** from Memphis, Tenn., to Ripley, Miss. Present rate, 260c per net ton. Proposed rate on sand, carloads, minimum weight, 90% of marked capacity of car, except when cars are loaded to their visible capacity actual weight will govern—from Memphis, Tenn., to Ripley, Miss., 150c per net ton, same as in effect to G. M. & N. R. R. stations between Middleton and Jackson, Tenn.

CENTRAL FREIGHT ASSOCIATION DOCKET

15804. To establish on **crushed stone,** carloads, Marble Cliff, Ohio, to various points in Ohio, following rates:

From Marble Cliff, Ohio—Rates per net ton:

To	Prop.	Pres.	To	Prop.	Pres.
Ashville	70	80	Clifford	100	120
Circleville	75	80	Portsmouth	105	120
Kingston	80	90	Sciotoville	115	120
Chillicothe	85	90	Haverhill	115	120
Pride	90	100	Union Ldg.	115	140
Waverly	95	100	Ironton	125	140

15805. To establish on **sand,** except blast, engine, foundry, glass, loam, molding and silica, **and gravel,** carloads, Lake Ciecott, Ind., to Grand Rapids, Mich., rate of 185c per net ton. Present rate, 430c per net ton.

15807. To establish on **sand,** except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing loam, molding or silica, **and gravel,** carloads, Wolcottville, Ind., to Waynedale, Ind., rate of 88c per net ton. Present rate, 115c per net ton.

15809. To establish on **stone, crushed,** in bulk, in open top cars, carloads, Woodville, Ohio, to Metamora, Lyons and Pioneer, Ohio, rates of 80c, 85c and 100c per net ton respectively. Present rate, 90c to Metamora and Lyons, Ohio, and 300c (6th class) to Pioneer, Ohio.

15827. To establish on **sand** and **gravel** (all kinds), carloads, Massillon, Ohio, and Navarre, Ohio, to Cadiz, Ohio, rate of 100c per net ton. Present rates, 13½c from Navarre, Ohio, and 140c per net ton from Massillon.

15837. To establish on **sand,** except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica, and **gravel,** carloads, Ginger Hill, Ind., to North Liberty, Ind., rate of 50c per net ton. Present rate, 58c per net ton.

15839. To establish on **gravel and sand,** other than blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica, and gravel, carloads, Volant, Penn., to New Castle, Penn., rate of 60c per ton of 2000 lb. Present rate, 70c per ton of 2000 lb.

15872. To establish on **stone, crushed,** in bulk, in open top cars, carloads, Gibsonburg, Maple Grove and Woodville, Ohio, to Greenwich and Willard, Ohio, respectively, rates of 90c and 85c per net ton. Present rate, 100c per net ton.

15873. To establish on **crushed stone,** in bulk, in open cars, carloads, Kenneth, Ind., to New Market, Ind., rate of 90c per net ton. Present rate, 113c per net ton.

15874. To establish on **stone, crushed,** in bulk, in open top cars, carloads, Gibsonburg and Woodville, Ohio, to Lindsey, Ohio, rate of 80c per net ton. Present rate, 100c per net ton.

15875. To establish on **crushed stone,** carloads, East Liberty, Ohio, to Dayton, Ohio, rate of 90c per net ton. Present rate, 100c per net ton.

15876. To establish on **crushed stone,** in bulk, in open cars, carloads, Kenneth, Ind., to Hagerstown, Ind., rate of 100c per net ton. Present rate, 127c per net ton.

SOUTHWESTERN FREIGHT BUREAU DOCKET

12487. **Crushed stone,** from Whitestone, Ga., to Tulsa, Okla. To establish the following rate on crushed stone, carloads, from Whitestone, Ga., to Tulsa, Okla.: $2.50 per ton of 2000 lb., minimum weight 90% of marked capacity of car, except that when cars are loaded to their visible capacity actual weight sha govern; plus $2.30 per ton, minimum weight 80,000 lb., or if marked capacity of car is less than 80,000 lb. marked capacity shall govern; plus $1.60 per ton, minimum weight marked capacity of car. The present basis is Memphis-Ft. Smith combination, and in order that lines operating via other junctions may be on a parity it is desired that the combination be published.

NEW ENGLAND FREIGHT ASSOCIATION DOCKET

12486. **Gravel,** run of bank or screened or crushed, and sand, common building, carloads, minimum weight 60,000 lb., from Topsfield, Mass., to Kittery Navy Yard Stations, Maine, 4 (to expire December 31, 1927). Reason—To meet motor truck combination.

12424. **Sand,** core, carloads, minimum weight 90% marked capacity of car, from Provincetown, Mass., to Troy, N. Y., $3.70 per ton of 2000 lb., via B. & A. R. R.-N. Y. C. R. R. Reason: To provide rate on same basis as in effect to contiguous points.

12436. **Sand,** common (not molding, fire, filter or blasting); gravel (run of the bank or screened), **stone, crushed** (trap rock), carloads, minimum weight marked capacity of car, but in no case less than 60,000 lb., from North Wilbraham and Westfield, Mass., to Holden, Mass., $1.30 per ton of 2000 lb., via B. & A. R. R.-Worcester, Mass.—B. & M. R. R. Reason: To establish same rate as applied to contiguous points.

12460. **Stone,** broken or **crushed,** in bulk, in gondola or other open top cars, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to cubical or visible capacity actual weight will apply, from New Britain (Cook's Quarry), Conn., to Ellington, Conn., 90c per ton of 2000 lb. (to expire with contract). Reason: To provide same rate as is now in effect from Rocky Hill, Conn.

TRUNK LINE ASSOCIATION DOCKET

15400. (A) **Sand** (other than blast, engine, foundry, glass, molding and silica) **and gravel,** carloads. (B) Sand, blast, engine, foundry, glass,

molding and silica, carloads; minimum weight 90% of marked capacity of car, except when car is loaded to cubical or visible capacity actual weight will apply, from Perth Amboy District, N. J., to stations on the Staten Island Rapid Transit Railway, Port Ivory to Tottenville, N. Y., inclusive, (A) $1.05 per ton of 2000 lb. and (B) $1.25 per ton of 2000 lb., subject to Rule 77. Reason: Proposed rates are comparable with rates now in force from and to points in the same general territory.

15436. **Sand,** carloads, minimum weight 90% of marked capacity of car, except when car is loaded to cubical or visible capacity actual weight will apply, from Mispah, N. J., to Malaga, Minotola and Newfield, N. J., 58c per ton of 2000 lb. (to expire December 31, 1927). Reason: To establish rate which will be comparable with those in force to Malaga from other sand shipping points, viz.: Manantico and Manumuskin, N. J.

15437. **Gravel and sand,** other than blast, engine, foundry, glass, molding or silica, carloads, from Machias, N. Y., to Cattaraugus and Dayton, N. Y., $1; Bear Lake and Columbus, Penn., $1.30 per ton of 2000 lb. Reason: Proposed rates are the same as published from Springville, N. Y., per B. R. & P. Ry. Tariff I. C. C. No. 8077.

15447. **Crushed stone,** carloads, minimum weight 90% of marked capacity of car, except when car is loaded to cubical or visible capacity actual weight will apply, from Port Deposit, Md., to Havre-de-Grace, Md., $16 per car. Reason: To establish same rate as is now applicable on gravel, carloads, between same points.

15471. (A) **Sand** (other than blast, engine, foundry, glass, molding, quartz, silex and silica), **and gravel,** carloads; (B) Sand, viz., blast, engine, foundry, glass, molding, quartz, silex and silica sand; from Tannery, Penn., to Penobscot and Solomons Gap, Penn., (A) 70c per net ton and (B) 72c per net ton. Reason: Proposed rates are comparable with rates from Wyoanna, Penn., to Mountain Top, Penn., as per L. V. R. R. Tariff I. C. C. C8085.

15490. **Sand,** other than blast, engine, foundry, molding, glass, silica, quartz or silex, carloads, also gravel, carloads, minimum weight 90% of marked capacity of car, except when car is loaded to cubical or visible capacity actual weight will apply, from Patapsco, Md., to Waldorf, Md., $1.05 per 2000 lb., subject to Rule 77. Reason—To establish rate which will be comparable with those in force to Cheltenham, Glencoe, Graystone, Md., New Freedom, Penn., etc., as per P. R. R. Tariff G. O. I. C. C. 14343.

15509. **Sand,** molding, blast, engine, foundry, glass and silica, minimum weight 90% of marked capacity of car, from Coxsackle, N. Y., to Troy and Green Island, N. Y., $1.20 per net ton. Reason—Proposed rate compares favorably with rates on like commodities from and to points in the same general territory.

15519. **Sand,** other than blast, engine, foundry, molding, glass, silica, quartz or silex, carloads, minimum weight 90% of marked capacity of car, etc., in Water Street, Penn., from Philadelphia, $2.20; Morrisville and Tullytown, Penn., $2.40 per ton of 2000 lb. Reason—To establish rates which will be comparable with those in force from and to points in the same general territory as per P. R. R. Tariffs G. O. I. C. C. 13546 and 14342.

WESTERN TRUNK LINE DOCKET

4742C. **Sand and gravel,** carloads, minimum weight 90% of marked capacity of car, except that when actual weight of shipments loaded to full visible capacity of car is less than 90% of marked capacity of car, the actual weight will be the minimum weight, except that in no case will the minimum weight be less than 40,000 lb., from Chilliocthe, Ill., to Iowa stations on the M. & St. L. R. R., of which the following are representative:

To	Rates in cents per net ton Iowa scale	Proposed
Oakville, Iowa	108.5	130
Morning Sun, Iowa	113	130
Brighton, Iowa	126.5	150
Hedrick, Iowa	139.5	160
Oskaloosa, Iowa	148.5	170

Proposed rates are based on the Iowa Distance Scale for single line, plus 20c per ton for the joint line haul.

Recent I. C. C. Decisions

17873. Reparation awarded on sand shipments from Cape May, N. J., to Radford, Va., in June, 1924. Defendants claim that silica sand rates were applicable, not sustained. Rates were in excess of $4.95 per ton, the prescribed rate for common sand.

17460. Gravel rates from Montgomery, Ala., to Barney, Ga., found to be in excess of $1.76 per ton and unjustified. Reparation awarded shipper on movement made from January to May, 1924.

16799. Gravel rates charged by the Southern Railway from Gravel Siding, Miss., to Arkansas destinations found overcharged and inapplicable. Refund ordered to shippers for shipments made since September 8, 1924. All shipments on which full combination rates on Memphis were assessed declared overcharged.

17491. Rates on lime, ground limestone, crushed stone from West Virginia and Ohio points to stations in Maryland on the W. B. and A. electric line and the H. & G. electric line not unreasonable nor inapplicable. No joint rates in effect at time shipments moved so full combination does not apply.

17370. Rate of $5.07 per long ton on crude rock phosphate in carloads from Telphoseo and Brewster, Fla., to Meridian, Miss., unreasonable in that it may exceed $4.73. Reparation awarded and new rate ordered established by July 6. Authorized carriers to maintain a rate of $4.62 to New Orleans and Gulf ports taking the same rates and rates at inland intermediate points as high as $5.78 per long ton.

New Sand and Gravel Rates for North Carolina

NEW rates for carload shipments of sand, gravel and other road building materials were ordered placed in effect on intrastate shipments on August 1.

The new rates will mean lower charges for single line short hauls and higher rates for joint line and longer hauls. The scale is the same as approved by the Interstate Commerce Commission for application to the southeastern territory. A majority of the standard lines of North Carolina agreed to the new scale, which was described in the commission order as follows:

"The application of the new scales within North Carolina will result in both reductions and increases compared with rates now in effect. For instance, for distances up to 230 miles there will be reductions for single line hauls on an average of 7 cents, and for joint line hauls an average of 10 cents per ton. For distances 230 to 450 miles there will be increases for single line hauls an average of 6 cents and on joint line hauls 3 cents per ton. When considering the entire scale for distances up to 450 miles there will be a reduction in single line hauls."—*Raleigh* (N. C.) *News.*

Chatt and Limestone Producers Confer on Rates at St. Louis

A JOINT CONFERENCE of railroad representatives and members of the traffic committee of the Midwest Division of the National Crushed Stone Association, together with representatives from the chatt producers of Southeastern Missouri, was held in the conference room of the Southwestern Freight Committee, Century Building, St. Louis, Mo., June 9, with the following in attendance:

C. K. Stroube, G. S. Robins & Co.; Evan G. Bringhurst, G. S. Robins & Co.; F. C. Murphy, Electric Limestone Co.; J. E. Brouchard, St. Joseph Lead Co.; B. W. La Tourette, M. R. & B. T. Railway; D. W. Longstreet, Illinois Central Railroad; H. P. McCormick, L. & N. R. R.; C. Anderson, M. & O. R. R.; G. C. Schmoll, Southern Railway; James P. Flannary, P. Flannary & Sons; A. H. Bannister, Brownell Improvement Co.; F. P. Sackbauer, M. I. Railroad and M. R. & B. T. Railway; F. E. Webster (by J. Cibulka), C. & E. I. R. R.; W. T. Stevenson (by P. J. Zimmer), C. C. C. & St. L. R. R.; E. J. McMahon, executive secretary, St. Louis Quarymen's Association; H. G. Wilson, T. M., Columbia Quarry Co.; E. J. Krause, president, Columbia Quarry Co., chairman, traffic committee, National Crushed Stone Association; W. R. Sanborn, vice-president, National Crushed Stone Association, vice-president, Lehigh Stone Co.; J. E. Weber, Casper Stolle Quarry and Contracting Co.; William J. Lahr, A. G. F. A., C. B. & Q. R. R. Co.; D. R. Lincoln, A. F. T. M., Missouri Pacific Railroad Co.

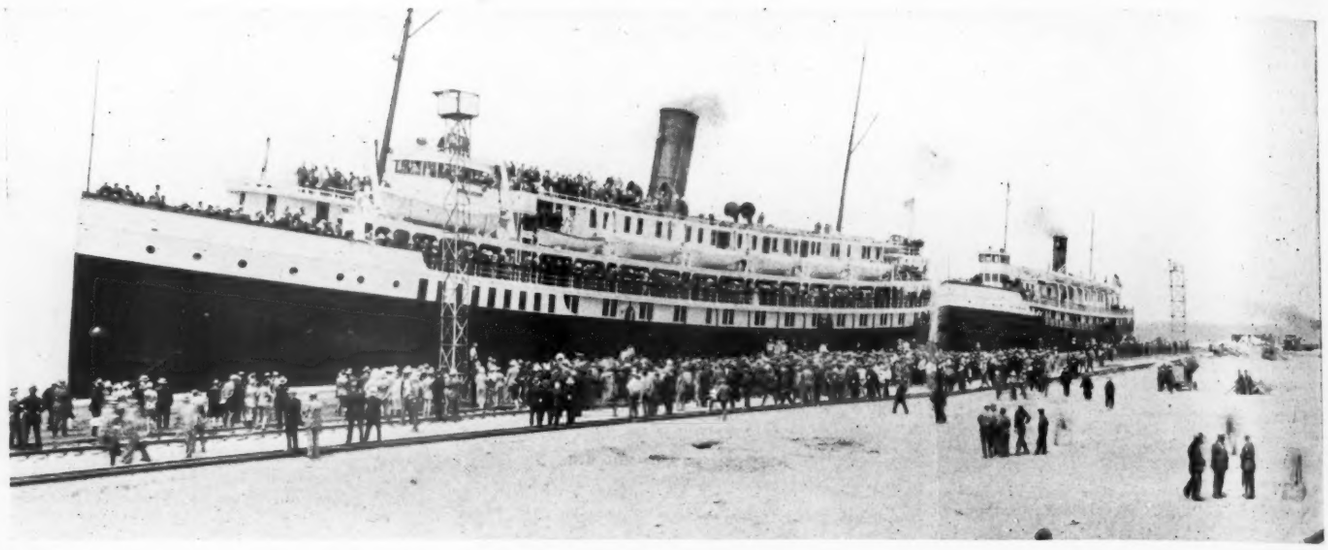
W. R. Sanborn, elected chairman of the meeting, outlined the purpose of the conference, which was called for the purpose of discussing the present rate adjustment on chatt carloads from M. R. & B. T. origin points to Illinois, particularly that destination territory on and south of the B. & O. Railroad. The limestone traffic committee had carefully analyzed the rate situation, chatt vs. limestone, and for the information of those present proceeded to read the letter of March 30 which this committee addressed to F. B. Bowes, vice-president of the Illinois Central System, Chicago, Ill. The numerous rate exhibits as supplied with this letter were then touched upon.

After a free discussion by all parties present it was recognized that nothing could be accomplished until the carriers had had the opportunity to go into the situation more thoroughly. It was then decided that two committees consisting of five members each should be appointed by carriers and shippers to act jointly, going into this question with the idea of working out some tangible adjustment.

D. W. Longstreet, traffic manager for the Illinois Central Railroad, appointed as the carriers' committee the Illinois Central, C. & E. I., Mobile & Ohio, Missouri-Illinois and Missouri Pacific railroads, Mr. Longstreet to act as chairman, the personnel of the committee to be announced later.

Mr. Sanborn appointed the following as shippers' committee: H. G. Wilson, chairman; C. A. Jones, E. J. McMahon, W. J. Womer and J. E. Brouchard, Mr. Brouchard to act as the representative for the chatt producers.

It will be the purpose of these two committees to hold individual and joint meetings as often as necessary, seeking to adjust this rate situation. The meeting then adjourned.



Some of the 3000 guests of the Universal Portland Cement Co. disembarking at Buffington harbor from the two special boats chartered to carry them to the dedication

Universal Portland Dedicates New Buffington Harbor

INAUGURATING a new transportation era in the construction and building material industry, Vice-President Charles G. Dawes on June 9 formally opened to navigation the new Buffington, Ind., harbor, the deepest harbor on the Great Lakes, the first private harbor to be built on Lake Michigan in 20 years and one of only three such harbors on all the Great Lakes, the others being at Gary, Ind., and at Calcite, Mich.

Three thousand persons, including nationally known architects, engineers, contractors, public officials and civic leaders, attended the opening as guests of B. F. Affleck, president of the Universal Portland Cement Co., which built and owns the harbor. In addition to Vice-president Dawes, other prominent men who participated were U. S. Senator James E. Watson of Indiana, Congressman E. W. Sproul of Illinois, Mayor R. P. Hale of East Chicago, E. J. Buffington, president of the Illinois Steel Co., for whom the harbor was named, and T. W. Robinson, vice-president of that company; B. F. Affleck and Blaine S. Smith, president and vice-president of the Universal Portland Cement Co.; A. F. Harvey, president of the Pittsburgh Steamship Co.; Carl D. Bradley, president of the Bradley Transportation Co., and the Michigan Limestone and Chemical Co., and A. F. Banks, president of the Elgin, Joliet and Eastern railroad.

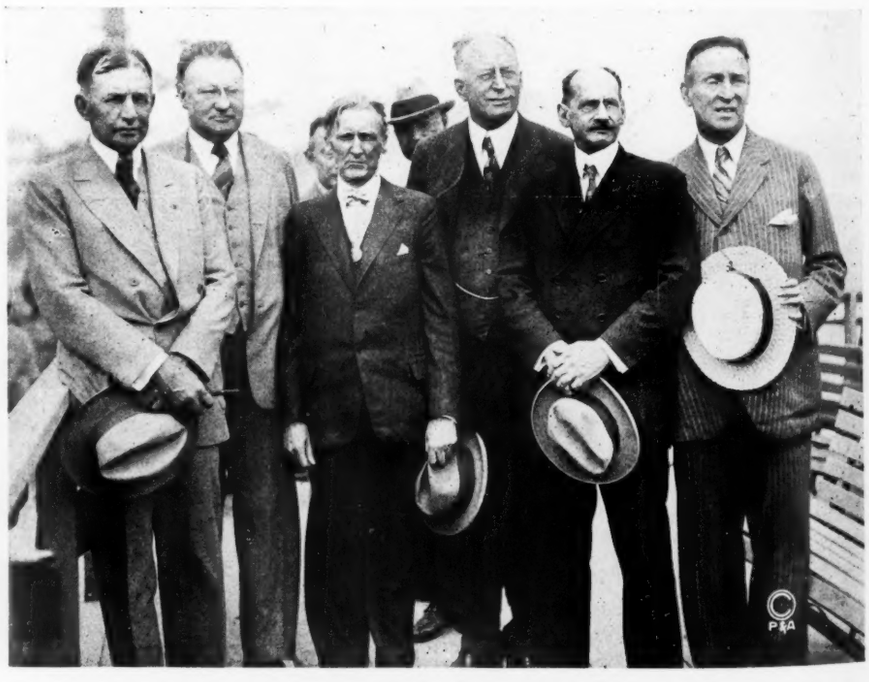
A feature of the event was the presence of two large freighters, the *T. W. Robinson*, a self-unloading vessel, and the *Eugene J. Buffington*, a standard steamer, each carrying 12,000 tons of Michigan limestone, which was unloaded during the ceremonies.

This substantial waterway improvement includes use of the largest fleet of freighters on the Great Lakes, with self-unloading craft that automatically discharge their huge cargoes at a ton a second, the largest movable boat-unloading bridge in the Chicago district for unloading standard steamers, a million-ton storage yard, a mile-long belt conveyor carrying material from dock to cement plant at the rate of six tons per minute, an 1800-ft. concrete dock wall, 600 ft. wide, that provides facilities at the same time for unloading limestone and loading cement for shipment, a 2000-ft. massive breakwater and an all-concrete lighthouse with an electric beacon visible 13 miles away.

The opening of Buffington harbor improves and enlarges the shipping facilities of the Universal company and enables the company to receive by boat and store large quantities of raw materials and to ship cement by both rail and water to all points on the Great Lakes and in the Mississippi valley.

Launch B. F. Affleck at Toledo

THE *B. F. Affleck*, recently built for the Pittsburgh Steamship Co. to engage in ore carrying and limestone from Michigan to steel plants and cement mills at Chicago, Buffington, Gary, Lorain and Duluth, and coal from points on Lake Erie to ports on Lake Michigan and Lake Superior, is to be launched at Toledo on June 25. The boat



A group of prominent men participating in the dedication ceremonies. Left to right, Vice-President Charles G. Dawes, Senator James E. Watson, E. J. Buffington, president of Illinois Steel Co., for whom harbor was named; B. F. Affleck, president of Universal Portland Cement Co.; T. W. Robinson, vice-president of Illinois Steel Co.; Carl D. Bradley, president, Michigan Limestone and Chemical Co., operating the largest quarry in the world

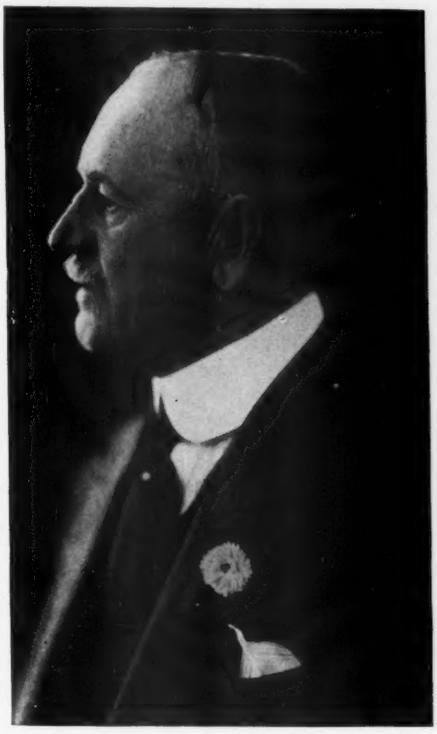
will be christened by Mrs. B. F. Affleck.

The new freighter is a 12,000-ton vessel, 604 ft. long and 60 ft. wide. The motive power includes a triple expansion engine and three Scotch marine boilers. It is one of the units in the lake-carrying development of the Universal Portland Cement Co., a feature of which was the recent formal opening of the new Buffington harbor.

R. W. Lesley Elected Honorary Member of A. S. T. M.

ROBERT W. LESLEY, prominent in the cement industry of the United States for almost half a century, was recently elected an honorary member of the American Society for Testing Materials. The vote was unanimous. This honor was conferred upon him June 22 at the annual meeting of the society at French Lick Springs, Ind.

Mr. Lesley began his business career in the office of the *Philadelphia Ledger* in September, 1868, serving in the business department and later as assistant editor. He began the study of law under Benjamin Harris Brewster, U. S. attorney general, and was admitted to the bar in 1879. In 1874 he organized the firm of Lesley & Trinkle to deal in cement. In 1880 he became associated with David O. Saylor in the pioneer work of establishing the American portland cement industry. Under inventions made by Mr. Lesley the American Cement Co. was organized, which later on became one of the largest manufacturers of portland cement in the United States. As a pioneer in the commercial introduction of American portland cement, he assisted in the development of the industry from an output of less than 50,000 bbl. to over 160,000,000 bbl. in 1926. After the outbreak of the war Mr. Lesley was appointed a member of the concrete ship committee of the American Concrete Institute. During the absence of Clarke Thomson in the army, Mr. Lesley took over the management of the Clarke Thomson Aviation Research, which was associated with the National Advisory Committee for Aeronautics. He was one of those who helped to organize the Philadelphia War Chest and has served as captain of teams in securing money for the various national Liberty Loans, War Savings Stamps, Red Cross and Philadelphia War Chest; chairman Jackson Mills Emery Co., Inc., of New York; past president and honorary member Portland Cement Association and past vice-president American Society for Testing Materials. Member American Society of Civil Engineers' Committee on Concrete and Reinforced Concrete; member and chairman sub-committee on ways and means, joint committee on concrete and reinforced concrete and American Society for Testing Materials' Committee C-I on Cement Specifications. Member American Chemical Society and British Chemical Society; chairman executive committee Giant Portland Cement Co.; presiding officer cement section of International Congress of Association for Testing Materials, New York, 1912; associate American Society of Civil Engineers; member of government board on fuels and structural materials, appointed by President Roosevelt; honorary member



Robert W. Lesley

Portland Cement Association; member Philadelphia Chamber of Commerce; manager The Franklin Institute. Director Giant Portland Cement Co., Bonzano Rail Joint Co., Surface Combustion Co., Inc., of New York; Tidewater Land Co. Past president Philadelphia Golf Association; vice-president Merion Cricket Club Golf Association; past president Senior's Golf Association of United States. Member of Championship and Sectional Affairs Committee of United States Golf Association. President Merion Cricket Club. Consulting editor *Concrete*, Chicago. Clubs: Merion, Bryn Mawr, Polo, Engineers' Clubs of New York and Philadelphia, Rittenhouse Club, Railroad Club of New York. Business address, 611-612 Pennsylvania Building, Philadelphia, Penn. Home address, Lesselyn Court, Haverford, Penn.

Start Limestone Shipments to Louisiana Portland Mill

INAUGURATION of shipments of limestone through Mobile to New Orleans began June 1 when three barges of the Warrior Line left St. Stephen's Bluff with 1500 tons of rock taken from quarries in the side of the bluff. The limestone, part of large deposits located in that region, is being exploited by the Louisiana Portland Cement Co., which has established handling devices and installed expensive machinery to develop the material. An investment of approximately $500,000 has been made.

Under contract with the company, the barge line is to move stated quantities of limestone from St. Stephen's Bluff to New Orleans until a $12,000 Diesel-engined towboat and fleet of barges planned are completed for the company, but it is not expected this boat will be in service on the river before the first of July. The Louisiana company has purchased a towboat in New York and this vessel is now on its way down the Atlantic coast. A large number of barges also have been bought and will soon be engaged in this traffic. Within a short time the company expects to ship through Mobile 15,000 tons of material from Pelham's Landing monthly.

The St. Stephen's Bluff project represents an investment of thousands of dollars in machinery and equipment. The company has built wharves and buildings, installed power plants, and has created a city in miniature on the banks of the river. A modern belt conveyor system will carry the crushed limestone from the crushers to the barges.

The development came about early this year when the Louisiana company decided to supplement the original plan of using Louisiana oyster marl.

The Louisiana Portland Cement Co. is a subsidiary of the International Cement Corp., New York. The plant when completed will produce about 2500 bbl. per day from two kilns, 9x8x220 ft., using the wet process. A. D. Stancliff is superintendent of the plant.—*Mobile* (Ala.) *Item.*

William Dolese

WILLIAM DOLESE, pioneer Chicagoan, formerly of Dolese & Shephard Co. and Dolese Bros. Co., producers of crushed stone, died of heart disease in his home, 5341 West 22nd Street, Cicero, June 13, after a long illness.

Mr. Dolese was born sixty-eight years ago in the old Bridgeport district near 33rd and Church Streets. After the death of his father, John Dolese, William and his three brothers, Peter, John and Henry, established the Dolese Bros. Co., which has quarries in various sections of the country, including one in south Cicero. He was the first president of the company and held office until a few years ago.

Besides his three brothers, he is survived by his widow, Augusta; a son, John; a daughter, Miss Marie Dolese, and four sisters, Minnie, Ida and Rose Dolese and Mrs. Charles A. Klotz. The funeral was held June 15. Burial was in Oakwoods cemetery.

Mr. Dolese's grandfather, Pierre Dolese, came to Chicago from France in 1833. He established and operated a tavern for many years at what is now Lake and La Salle Streets.

National Sand and Gravel Directors to Meet in Chicago, June 28 and 29

THE Board of Directors of the National Sand and Gravel Association will meet in Chicago, June 28 and 29. The first day's session will be open only to members of the board; the second day's session will be open to all members of the association. All members who can do so are requested to attend.

This meeting is being held in accordance with a resolution passed at the annual convention held in Cincinnati. The main subject to be discussed is a plan of expanding the research work of the association. This work has been very successful and it has been thought by many prominent members that it could be carried farther with even greater success. After several plans for extending the work have been considered, the directors will make a report that will be presented to the membership at the open meeting on June 29.

Another matter to be brought up at this meeting is the selection of the city in which the national convention of the association will be held. Invitations have been received from almost all the leading cities of the United States.

It is possible that the summer meeting of the association may come to be a regular feature and perhaps take the place of the annual convention. Concerning this, the *National Sand and Gravel Bulletin* says:

Many prominent members of the association feel that the time has come for considering the possibility of holding the annual conventions during the summer months rather than the winter months as has been the custom of the organization from the beginning. It will be interesting, therefore, to observe the amount of attendance upon the part of members at the Chicago meeting in June. The sessions will last only for two days, and it will be very much worth while for all to be there.

Glass Sand Producers Are Interested in This Investigation

PLANS for the field work in connection with the cost of production investigation of window glass are now being mapped out by the United States Tariff Commission, it was announced orally at the Commission on June 18.

J. Mark Allerton, a specialist in the production and manufacture of window glass, has been tentatively selected to superintend the work. He will be assisted by a group of accountants and economists.

Mr. Allerton, it was explained officially, will visit 20 manufacturing plants in this country. The work will begin some time after July 4, and according to present plans will extend to California.

It will take probably three months to complete the work, which will be confined chiefly to the cost of producing the domestic product.

The commission in the meantime is also mapping out a program to cover the task of compiling foreign production costs, it was said.

The window glass investigation was ordered by the commission on May 26, 1927. Manufacturers of window glass, principally in Pennsylvania, are vitally interested in this industry, having already complained to the commission of their inability to compete with foreign manufacturing, it was declared.

Through Senator Shortridge of California, it was said, another series of complaints have reached the commission, for a production cost survey in that state.

Three Jersey Sand and Gravel Companies Merged

A RECENT announcement in the *Asbury Park* (N. J.) *Press* reports the incorporation of the New Jersey Sand and Gravel Co. with estimated assets of over $1,250,000. The new corporation is the result of a merger of three well-known and successful gravel companies—the Bennett Gravel Co. of Spring Lake, the Wall Washed Sand and Gravel Co. of Spring Lake, and the Hause Washed Gravel and Sand Co., whose two plants are in the Asbury Park section, one on Green Grove road north of Asbury avenue, the other a new one near Wayside. The total production of the new company this year, it is estimated, will be 500,000 tons. When the present program of improvements is completed it is declared the plants will take care of the New Jersey shore's needs for many years to come.

Officers of the New Jersey Sand and Gravel Co. are: President, J. Claude English; vice-president, David Newman; secretary, Elmer H. Geran, and treasurer, Russell Yawger. The directors include Fred F. Schock, president of the First National Bank of Spring Lake and a director of the Bennett Gravel Co.; Charles Lawrence, also a director in the Bennett Gravel Co.; David Newman, vice-president of the First National Bank of Avon and one of the owners of the Wall company; Taulman A. Miller, vice-president of the Ocean Grove National Bank; J. Claude English and Fred W. Hause of the Hause Washed Gravel and Sand Co.; Russell Yawger, cashier of the Allenhurst National Bank; Edwin R. Conover, cashier of the Broad Street National Bank of Red Bank; Elmer H. Geran, director in the Matawan and the Broad Street National Bank of Red Bank, and Newton K. Bugbee, comptroller of the state of New Jersey, resident of the Hanover Trust Co. of Trenton and interested in other banks.

The capital of the New Jersey Sand and Gravel Co. is 4000 shares of preferred stock and 10,000 of common of no par value. The estimate of $1,250,000 in assets is based on valuations made by Ford, Bacon and Davis, engineers, of New York City, and audited by David Berdon and Co.

The member companies will maintain a more or less individual existence, except for centralization of sales effort, etc., it is said. Charles Lawrence will be in charge of the Bennett plant, Arthur Newman of the Wall company, and Fred Hause of the Hause company.

The Bennett company was organized about 10 years ago and has steadily grown until at the present time it is producing about 300,000 tons of washed and screened material annually. A description of its new sand blast sand and filter sand plant was published in Rock Products, September 19, 1925. Four years ago David, Arthur and Preston Newman formed the Wall Washed Sand and Gravel Co., whose main volume of business was a matter of truck delivery. The Wall company now has a production schedule of 75,000 tons annually.

The third company entering the merger entered production in 1924 when Fred Hause organized the Hause Washed Gravel and Sand Co. With him were associated Allen R. Hueth and J. Claude English. In 1927 their plant was overtaxed and an auxiliary operation was established in Wayside, which increased the capacity of the concern's equipment to 100,000 tons annually.

Central offices of the new company will be in the First National Bank building in Spring Lake.

Buys Steilacoom Gravel Property

PURCHASE by J. T. Heffernan, Seattle capitalist and realty magnate, of a gravel pit 350 acres in extent, located near Steilacoom, Wash., involved a consideration of nearly a half million dollars, Carter, MacDonald & Miller, Inc., stated recently in announcing the transaction. Thomas McGill of that office represented Heffernan and the seller, the State Gravel Co.

The property is said to be one of the largest bodies of commercial gravel in the state and is estimated to contain 80,000,000 yd. The bank of gravel is 250 ft. in depth. The pit equipment is valued at about $130,000. —*Seattle* (Wash.) *Post-Intelligencer.*

Erratum

THE correct address of H. S. Anderson, the inventor of the improved type of gyratory crusher described in Rock Products, June 11, 1927, p. 115, is at Waterville, Iowa.

Sand-Lime Brick Production and Shipments in May

THE following data are compiled from reports received direct from 29 producers of sand-lime brick located in various parts of the United States and Canada. The number of plants reporting is one less than those furnishing statistics for the April estimate published in the May 28 issue. The statistics below may be regarded as representative of the entire industry, the reporting plants having over two-thirds the production capacity in the United States and Canada.

Production and shipments showed good improvement over the past month, but new business in general is not what it might be. Producers are not complaining, in fact some of them are quite optimistic about a betterment of conditions, these beliefs being based on more favorable weather for building. Several plants in the Middle West have discontinued operations for different reasons. Florida continues in the doldrums—one of the plants reporting that it is rushing the brick through the kilns and piling up finished brick with the intention of closing its plant for the summer. Conditions there are pretty bad, with business failures rather numerous and the future outlook not too bright.

The three-kiln plant at Pacific, Mo., under construction by the Hardstone Brick and Tile Co. will soon go into production. The two steam boilers are being installed and the foundation for the 150-ft. stack already is in. The rod mill and other equipment is on the job, awaiting setting.

Manufacturers' quoted prices were about the same as the past month. The following are the average prices quoted for sand-lime brick in May:

Average Prices for May

Shipping point	Plant price	Delivered
Atlantic City, N. J.	$14.00	.....
Buffalo, N. Y.	12.25	$16.50
Toronto, Canada	.....	14.00
Rochester, N. Y.	.....	19.75
Jackson, Mich.	12.25	.....
Syracuse, N. Y.	18.00	20.00
Milwaukee, Wis.	10.50	13.00
Minneapolis, Minn.	10.00	12.75
Michigan City, Ind.	11.00	.....
Detroit, Mich.	.....	16.50
Sebewaing, Mich.	.....	.....
Dayton, Ohio	12.50	.....
Grand Rapids, Mich.	12.50	.....
Sioux Falls, S. D.	13.00	.....
Albany, Ga.	10.00	.....
Detroit, Mich.	13.25	16.50
New Orleans, La.	.....	.....
Saginaw, Mich.	11.50	.....
Toronto, Canada	13.50	16.00
Woburn, Mass.	.....	16.00
Detroit, Mich.	.....	16.62
Lake Helen, Fla.	10.60	.....
Detroit, Mich.	12.00	15.10
Plant City, Fla.—		
White	10.00@11.00	.....
Buff	15.00	.....
Menominee, Mich.	11.00	14.50
Detroit, Mich.	.....	17.14
Hartford, Conn.	14.00	18.00
East Chicago, Ind.	9.00	.....
Pontiac, Mich.	13.00	17.00

The following statistics are compiled from data received direct from 29 producers of sand-lime brick in the United States and Canada:

Statistics for April and May, 1927

	April*	May†
Production	16,217,891	23,225,352
Shipments (rail)	6,229,545	8,195,711
Shipments (truck)	11,894,650	13,250,505
Stocks	9,779,381	8,739,717
Unfilled orders	18,463,200	17,237,000

*30 plants reporting. Revised to include two plants not furnishing April data previously.

†Incomplete, two plants not giving data on stocks and nine plants not giving unfilled orders.

New contracts for brick are reported from the Bond Sandstone Brick Co., Lake Helen, Fla., who are furnishing about 1,500,000 brick for the new Volusia county court house. The Sand-Lime Products Co., Detroit, Mich., are supplying the new Barlum Hotel and the Tempstedt Mfg. Co.'s plant in Detroit, the new vocational school in Highland Park, and the Mayflower Hotel at Plymouth, Mich. The new 13-story Jackson City Bank Building Jackson, Mich., is being supplied by the Jackson Brick Co., and the Sioux Falls (S. D.) Pressed Brick Co. is furnishing about 120,000 brick for various building jobs in and around Sioux Falls.

Report Option on Washington Cement Plant Site

ACCORDING to announcement in the *Everett* (Wash.) *Herald*, New York interests are said to be holding an option at Fortson, Wash., on property known as the Galbraith-Bacon place and that considerable survey work has been done in the interests of a cement plant. The option taken, it was stated, has some time to run.

Investigations on the Fortson properties have been in progress for six or eight months and were completed a few weeks ago, it was stated. Preliminary plans, as heard by residents of the district, were that limestone and clay would be taken out at Fortson and shipped to a coast point for manufacturing purposes. Later it was indicated that the plant would be erected at Fortson.

The surveys recently made were to ascertain the amount available on the properties under option and the expenditure involved in taking the material from the ground.

Kentucky Rock Asphalt Co. Not Involved in Merger

THE Kentucky Rock Asphalt Co., having offices in the Marion E. Taylor Building, Louisville, Ky., and a large plant at Kyrock, Ky., is not involved in the merger of rock asphalt interests, it was announced by W. H. Tarvin, president.

Mr. Tarvin advanced a number of reasons for the company's not considering the merging of its holdings or identity with those of other rock asphalt interests.—*Louisville* (Ky.) *Times.*

Montana Asbestos Project Under Development

A GOOD showing of marketable asbestos has recently been disclosed at the properties of the Vermiculture and Asbestos Co., near Libby, Mont., says F. J. Buck, production manager of the company in a letter to ROCK PRODUCTS.

Mr. Buck continues:

"The almost pure deposit has been uncovered in the face of the west quarry. This chute at present is over 16 ft. in width, with only one wall in sight, averaging less than 2% grits.

"As development progresses, the material is being stored in the stock pile, awaiting the completion of a ground tramway for the inauguration of regular shipments.

"The market for asbestos at present is very promising and satisfactory. The company is pushing development which will add considerably to its producing capacity and earning power."

Mr. Buck, with the assistance of Ira C. Miller, county surveyor, is rushing a survey and plans for the tramway which will have a capacity capable of delivering 200 tons of asbestos daily into the loading bins.

New South Dakota Crushing Plant

JOSEPH NONNAST is reported to have started construction of a new limestone crushing plant at Whitewood, S. D. The plant is being erected by Johnson Bros., Rapid City, S. D., and will have a daily capacity of six cars of crushed and screened limestone.—*Minneapolis* (Minn.) *Journal.*

To Develop Florida Travertine

THE Florida Travertine Co. has been organized recently at Bradenton, Fla., by interested parties from Bradenton and elsewhere to quarry and market the deposit of travertine rock lately discovered just east of the town. (ROCK PRODUCTS, April 30 issue.) The company plans to build a plant on the property which comprises 80 acres and is said to contain sufficient stone to insure operation for a considerable length of time. The rock from this deposit is said to compare favorably with the imported Italian stone.

The following are those directly connected with the new organization: Maj. George L. Jones of Bradenton and Baltimore; George W. Yeoman of Detroit, Mich., formerly vice-president of the Continental Motors Corp.; Leadley Ogden, builder of Sarasota; M. C. Erwin, engineer of Sarasota; Len H. Rounds of Sarasota; Screven Bond of Sarasota; H. F. Tinnerholm, assistant superintendent of the Clyde-Mallory Line, Jacksonville; Zern Bissell of Bradenton; Wilkie J. Schell of the Schell-Sassee Mfg. Co., Jacksonville; M. O. Huck of the M. O. Huck Paint Co. of Jacksonville.—*Tampa* (Fla.) *Times.*

The Rock Products Market

Wholesale Prices of Crushed Stone

Prices given are per ton, F.O.B., at producing point or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Buffalo, N. Y.	1.30	1.30	1.30	1.30	1.30	1.30
Chaumont, N. Y.	.50	1.75	1.75	1.50	1.50	1.50
Chazy, N. Y.	.75	.....	1.60	1.30	1.30	1.30
Coldwater, N. Y.—Dolomite			1.50 all sizes			
Danbury, Conn.	2.25	2.25	2.00	1.75	1.50	.....
Dundas, Ont.	3.04	1.05	1.05	.90	.90	.90
Frederick, Md.	.50@ .75	1.20@1.30	1.15@1.25	1.10@1.15	1.10@1.15	1.05@1.10
Munns, N. Y.	1.00	1.50	1.50	1.40	1.25	.....
Northern New Jersey	1.60	1.50@1.80	1.30@2.00	1.40@1.60	1.40@1.60	.....
Prospect, N. Y.	1.00	1.50	1.40	1.30	1.30	.....
Walford, Penn.	.....	.....	1.35h	1.35h	1.35h	1.35h
Watertown, N. Y.	1.00	.....	1.75	1.50	1.50	1.50
Western New York	.85	1.25	1.25	1.25	1.25	1.25
CENTRAL:						
Afton, Mich.	.....	.....	.....	.75	.75	1.50
Alton, Ill.	1.85	.....	1.85	.....	.....	.....
Buffalo, Iowa	1.10	.....	1.50	1.30	1.35	1.35
Chasco, Ill.	1.00@1.30	.....	1.00@1.15	.....	1.00@1.15	.....
Columbia, Krause, Valmeyer, Ill.	1.10@1.50	1.10@1.25	1.20@1.35	1.10@1.35	1.10@1.35	‖1.25
Flux (Valmeyer)	1.10@1.50	.....	.....	1.75	.....	1.75
Greencastle, Ind.	1.25	1.25	1.15	1.05	.95	.95
Lannon, Wis.	.80	1.00	1.00	.90	.90	.90
Linwood, Iowa	.95e	.....	1.50[1]	1.40[2]	1.30[3]	.....
McCook, Ill.	1.00	1.25	1.25	1.25	1.25	1.25
River Rouge, Mich.	1.20	1.20	1.20	1.20	1.20	1.20
Milltown, Ind.	.....	.90@1.00	1.00@1.10	.90@1.00	.85@ .90	.85@ .90
Mt. Vernon, Ill.	1.10@1.20	1.00	1.00	1.00	1.00	.....
Sheboygan, Wis.	1.10	1.10	1.10	1.10	1.10	1.10
Stone City, Iowa	.....	.....	1.20	1.10	1.00	.....
St. Vincent de Paul, Que. (A)	.80	1.25	1.00	.95	.95	.95
Toledo, Ohio	1.60	1.70	1.70	1.60	1.60	1.60
Toronto, Ont.	1.55	2.05	2.05	1.90	1.90	1.90
Waukesha, Wis.	.90	.90	.90	.90	.90	.90
Wisconsin Points	.50	.....	1.00	.90	.90	.....
Youngstown, Ohio	.70j	1.25l@1.35h	1.25l@1.35h	1.25l@1.35h	1.25l@1.35h	1.25l@1.35h
SOUTHERN:						
Alderson, W. Va.	.40	1.45	1.35	1.25	1.20	.....
Atlas, Ky.	.50	1.00	1.00	1.00	1.00	1.00
Brooksville, Fla.	.75	.....	2.65	2.65	2.40	2.00
Cartersville, Ga.	1.15	1.65	1.65	1.40	1.15	.....
Chico, Tex.	1.00	1.35	1.25	1.20	1.10	1.00
El Paso, Tex.	1.00	1.00	1.00	1.00	1.00	.....
Ft. Springs, W. Va.	.50	1.35	1.35	1.20	1.20	.....
Graystone, Ala.			Crusher run, screened, $1 per ton			
Kendrick and Santos, Fla.			3½ in. and less, $1 per ton			
Ladds, Ga.	.....	1.65	1.65	1.35	1.15	1.15
New Braunfels, Tex.	.60	1.25	1.10	.90	.90	.90
Rocky Point, Va.	.50@ .75	1.40@1.60	1.30@1.40	1.15@1.25	1.10@1.20	1.00@1.05
WESTERN:						
Atchison, Kans.¶	.50	1.90	1.90	1.90	1.90	1.80
Blue Springs & Wymore, Neb.	.25	1.45	1.45	1.35c	1.25d	1.20
Kansas City, Mo.	1.00	1.60	1.60	1.60	1.60	1.60
Cape Girardeau, Mo.	1.25	.....	1.25	1.25	1.00	.....
Rock Hill, St. Louis Co., Mo.	1.45	1.45	1.45	1.35	1.35	1.35

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Branford, Conn.	.80	1.70	1.45	1.20	1.05	.....
Duluth, Minn.	.90	2.25	1.75	1.55	1.35	1.25
Dwight, Calif.	1.00	1.00	1.00	.90	.90	.....
Eastern Maryland	1.00	1.60	1.60	1.50	1.35	1.35
Eastern Massachusetts	.85	1.75	1.75	1.25	1.25	1.25
Eastern New York	.75	1.25	1.25	1.25	1.25	1.25
Eastern Pennsylvania	1.10	1.70	1.60	1.50	1.35	*1.35
Knippa, Tex.	2.50	2.25	1.55	1.45	1.25	.....
New Haven, New Britain, Meriden and Wallingford, Conn.	.80	1.70	1.45	1.20	1.05	1.05
Northern New Jersey	1.60	2.10	1.90	1.50	1.50	.....
Oakland and El Cerito, Calif.	1.00	1.00	1.00	.90	.90	.....
Richmond, Calif.	.75	.....	1.00	1.00	1.00	.....
San Diego, Calif.	.70	2.00	1.50	.....	1.25	1.25
Springfield, N. J.	1.70	2.20	2.10	1.70	1.60	1.60
Toronto, Ont.	.....	3.58@4.05	3.05@3.80	.....	.....	.....
Westfield, Mass.	.60	1.50	1.35	1.20	1.10	.....

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Berlin, Utley, Montello and Red Granite, Wis.—Granite	1.80	1.70	1.50	1.40	1.40	.....
Columbia, S. C.—Granite	.....	2.00	1.75	1.75	1.60	.....
Eastern Penn.—Sandstone	1.35	1.70	1.65	1.40	1.40	1.40
Eastern Penn.—Quartzite	1.20	1.35	1.25	1.20	1.20	1.20
Emathla, Fla.			Crushed flint rock, 2.50 per cu. yd.			
Graystone, Ala.—Granite	.50	.....	.....	.....	.....	.....
Lithonia, Ga.	.75a	1.75b	1.60	1.40	1.35	.....
Lohrville, Wis.—Granite	1.65	1.70	1.65	1.45	1.50	.....
Middlebrook, Mo.	3.00@3.50	.....	2.00@2.25	2.00@2.25	.....	1.25@3.00
Richmond, Calif.—Quartzite	.75	.....	1.00	1.00	1.00	.....
Rochester, N. Y.			Dolomite, all sizes, $1.50 per ton			
Somerset, Penn. (sand-rock)			1.50 to 1.85			
Toccoa, Ga.—Granite	.50	1.35	1.35	1.30	1.25	1.25

*Cubic yd. †1 in. and less. ‡Two grades. ‖Rip rap per ton. (a) Sand. (b) to ⅜ in. (c) 1 in., 1.40. (d) 2 in., 1.30. ¶Rip rap 1.60 per ton. (f) ¼ in. (h) Less 10c discount. (j) Less 10% net ton. (l) Less .05. (e) Agstone to June 15, 1927. [1] ¾ to ¼ in. [2] 1 to ¼ in. [3] 1½ to ¼ in. (A) Ballast .80.

Agricultural Limestone

(Pulverized)

Alderson, W. Va. — Analysis, 90% $CaCO_3$; 50% thru 50 mesh	1.50
Alton, Ill.—Analysis 99% $CaCO_3$, 0.3% $MgCO_3$; 90% thru 100 mesh	6.00
Atlas, Ky.—90% thru 100 mesh	2.00
50% thru 100 mesh	1.00
Bettendorf and Moline, Ill.—Analysis, $CaCO_3$, 97%; 2% $MgCO_3$; 50% thru 100 mesh, 1.50; 50% thru 4 mesh	1.50
Blackwater, Mo.—100% thru 4 mesh	1.00
Branchton and Osborne, Penn.—100% thru 20 mesh; 60% thru 100 mesh; 45% thru 200 mesh. (Less 50 cents commission to dealers)	5.00
Brandon and Middlebury, Vt. — Pulverized, burlap bags, 6.00; paper, $5.00; bulk	4.00
Cape Girardeau, Mo.—50% thru 50-mesh	1.50
Cartersville, Ga.—50% thru 50-mesh	1.50
Charleston, W. Va.—Marl, per ton, bulk	3.00
Chaumont, N. Y.—Pulverized limestone, bags, 4.00; bulk	2.50
Chico, Tex.—50% thru 50 mesh, 1.75; 50% thru 100 mesh	2.25
Colton, Calif.—Analysis, 90% $CaCO_3$, bulk	4.00
Cypress, Ill.—90% thru 100 mesh	1.35
Ft. Springs, W. Va.—50% thru 4 mesh	1.50
Hillsville, Penn.—Analysis, 94% $CaCO_3$; 1.40% $MgCO_3$; 75% thru 100 mesh; sacked	5.00
Hot Springs and Greensboro, N. C.—Analysis, $CaCO_3$, 98-99%; $MgCO_3$, 42%; pulverized; 67% thru 200 mesh; bags	3.95
Bulk	2.70
(Paving dust)—80% thru 200 mesh, bags	4.25@ 4.75
Bulk	3.00@ 3.50
Jamesville, N. Y. — Analysis, 89.25% $CaCO_3$; 5.25% $MgCO_3$; pulverized, bags, 4.25; bulk	2.75
Joliet, Ill.—Analysis, 52% $CaCO_3$; 44% $MgCO_3$; 90% thru 100 mesh	3.50
Knoxville, Tenn.—80% thru 100 mesh, bags, 3.95; bulk	2.70
80% thru 200 mesh, bags, 4.25; bulk	3.00
Ladds, Ga.—Analysis, $CaCO_3$, 64%; $MgCO_3$, 32%; pulverized; 50% thru 50 mesh	1.50@ 2.75
Marblehead, Ohio — Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$; 60% thru 100 mesh; 70% thru 50 mesh; 100% thru 10 mesh; 80 lb. paper sacks, 5.00; bulk	3.50
Marlbrook, Va.—Marl, per ton, bulk	2.25
Marion, Va. — Analysis, 90% $CaCO_3$, pulverized, per ton	2.00
Middlebury, Vt. — $CaCO_3$, 99.05%; 50% thru 200 mesh; sacked	5.00@ 6.00
Milltown, Ind. — Analysis, 94.50% $CaCO_3$, 33% thru 50 mesh, 40% thru 50 mesh; bulk	1.35@ 1.60
Olive Hill, Ky.—90% thru 4 mesh	1.00
Piqua, Ohio—Total neutralizing power 95.3%; 99% thru 10, 60% thru 50; 50% thru 100	2.50@ 2.75
100% thru 10, 90% thru 50, 80% thru 100; bags, 5.10; bulk	3.60
99% thru 100, 85% thru 200; bags, 7.00; bulk	5.50
Rocky Point, Va.—Analysis, $CaCO_3$, 95%; 50% thru 200 mesh, burlap bags, 3.50; paper, 3.25; bulk	2.00
Syracuse, N. Y. — Analysis 89% $CaCO_3$; $MgCO_3$, 4%; bags, 4.25; bulk	2.75
Toledo, Ohio—30% thru 50 mesh	2.25
Watertown, N. Y.—Analysis, 96-99% $CaCO_3$; 50% thru 100 mesh; bags, 4.00; bulk	2.50
West Stockbridge, Mass. — Analysis, 90% $CaCO_3$, 50% thru 100 mesh; cloth bags, 4.75; paper, 4.25; bulk	3.25

Agricultural Limestone

(Crushed)

Alton, Ill.—Analysis, 99% $CaCO_3$, 0.3% $MgCO_3$; 50% thru 4 mesh	3.00
Atlas, Ky.—90% thru 4 mesh	1.00
Bedford, Ind. — Analysis, 98.5% $CaCO_3$, 0.5% $MgCO_3$; 90% thru 10 mesh; 25% thru 100 mesh; 50% thru 50 mesh	1.50

(Continued on next page)

Agricultural Limestone

Bridgeport and Chico, Texas—Analysis, 94% $CaCO_3$, 2% $MgCO_3$; 100% thru 10 mesh	1.75
50% thru 4 mesh	1.50
Chicago, Ill.—50% thru 100 mesh; 90% thru 4 mesh	.80
Columbia, Krause, Valmeyer, Ill.—Analysis, 90% $CaCO_3$; 100% thru 4 mesh	1.10@ 1.50
Cypress, Ill.—90% thru 50 mesh, 50% thru 100 mesh, 90% thru 50 mesh, 90% thru 4 mesh, 50% thru 4 mesh	1.35
Danbury, Conn.—Analysis, 79% $CaCO_3$, 11% $MgCO_3$; 60% thru 100 mesh; 80% thru 50 mesh; 100% thru 4 mesh; bags, 4.25; bulk	3.25
Dundas, Ont.—Analysis, 54% $CaCO_3$; $MgCO_3$, 43%; 50% thru 50 mesh	1.00
Ft. Springs, W. Va.—Analysis, 90% $CaCO_3$; 90% thru 50 mesh	1.50
Kansas City, Mo.—50% thru 100 mesh	1.00
Lannon, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 99% thru 10 mesh; 46% thru 60 mesh	2.00
Screenings (¼ in. to dust)	1.00
Marblehead, Ohio—Analysis, 83.54% $CaCO_3$, 14.92¼ $MgCO_3$, 32% thru 100 mesh; 51% thru 50 mesh; 83% thru 10 mesh; 100% thru 4 mesh (meal) bulk	1.60
Mayville, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 50% thru 50 mesh	1.85@ 2.35
McCook, Ill.—90% thru 4 mesh	.90
Middlepoint, Bellevue, Kenton, Ohio; Monroe, Mich.; Huntington and Bluffton, Ind.—Analysis, 42% $CaCO_3$, 54% $MgCO_3$; meal, 100% thru 4 mesh; 20% thru 100 mesh	1.50
Moline, Ill., and Bettendorf, Iowa—Analysis, 97% $CaCO_3$, 2% $MgCO_3$; 50% thru 100 mesh; 50% thru 4 mesh	1.50
Mountville, Va.—Analysis, 62.54% $CaCO_3$; $MgCO_3$, 35.94%, 100% thru 20 mesh; 50% thru 100 mesh, bags	5.50
Pixley, Mo.—Analysis, 96% $CaCO_3$; 50% thru 50 mesh	1.25
50% thru 100 mesh; 90% thru 50 mesh; 50% thru 50 mesh; 90% thru 4 mesh; 50% thru 4 mesh	1.65
River Rouge, Mich.—Analysis, 54% $CaCO_3$, 40% $MgCO_3$; bulk	.80@ 1.40
Stone City, Iowa—Analysis, 98% $CaCO_3$; 50% thru 50 mesh	.75
Tulsa, Okla.—Analysis $CaCO_3$, 86.15%, 1.25% $MgCO_3$, all sizes	1.25
Waukesha, Wis.—90% thru 100 mesh, 4.50; 50% thru 100 mesh	2.30

Pulverized Limestone for Coal Operators

Hillsville, Penn., sacks, 4.50; bulk	3.00
Joliet, Ill.—Analysis, 52% $CaCO_3$; 44% $MgCO_3$; 90% thru 100 mesh	3.50
Piqua, Ohio, sacks, 4.50@5.00; bulk	3.00@ 3.50
Rocky Point, Va.—92% thru 100, mesh, bulk	2.25@ 3.50
Waukesha, Wis.—90% thru 100 mesh, bulk	4.50

Glass Sand

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

Berkeley Springs, W. Va.	2.00@ 2.25
Buffalo, N. Y.	2.00@ 2.50
Cedarville and S. Vineland, N. J.—Damp	1.75
Dry	2.25
Estill Springs and Sewanee, Tenn.	1.50
Franklin, Penn.	2.25
Gray Summit and Klondike, Mo.	1.75@ 2.00
Klondike, Mo.	2.00
Los Angeles, Calif.—Washed	5.00
Mapleton Depot, Penn.	2.00@ 2.25
Massillon, Ohio	3.00
Mendota, Va.	2.25@ 2.50
Michigan City, Ind.	.35
Mineral Ridge and Ohlton, Ohio	2.50
Oceanside, Calif.	3.00
Ohlton, Ohio	2.50
Pittsburgh, Penn.	3.00@ 4.00
Ridgway, Penn.	2.50
Rockwood, Mich.	2.75@ 3.25
Round Top, Md.	2.00
San Francisco, Calif.	4.00@ 5.00
Silica, Va.	2.50
St. Louis, Mo.	2.00
Sewanee, Tenn.	1.50
Thayers, Penn.	2.50
Zanesville, Ohio	2.50

Miscellaneous Sands

City or shipping point	Roofing sand	Traction
Beach City, Ohio		1.75
Columbus, Ohio		.15@ .30
Dresden, Ohio		1.00@ 1.25
Eau Claire, Wis.	4.25	
Estill Springs and Sewanee, Tenn.	1.35@ 1.50	1.35@ 1.50

*Ground silica, carload.

(Continued on next page)

Wholesale Prices of Sand and Gravel

Prices given are per ton, F.O.B., producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
EASTERN:						
Ambridge & So. H'g'ts, Penn.	1.25	1.25	1.15	.85	.85	.85
Attica and Franklinville, N. Y.	.65	.65	.65	.65	.65	.65
Boston, Mass.‡	1.40	1.40	2.25		2.25	2.25
Buffalo, N. Y.	1.10	.95	.85			
Erie, Penn.		1.00*		1.50*	1.75*	
Farmingdale, N. J.	.58	.48	.85	1.25	1.15	
Leeds Junction, Me.		.50	1.75		1.25	1.00c
Machias Jct., N. Y.	.75	.75	.85	.75	.75	.75
Montoursville, Penn.	1.00	1.00	.90	.80	.80	.80
Portland, Me.		1.00	2.25		2.00	
Shining Point, Penn.			1.00	1.00	1.00	1.00
Somerset, Penn.		2.00				
South Heights, Penn.	1.25	1.25	.85	.85	.85	.85
Washington, D. C.	.85	.85	1.70	1.50	1.30	1.30
York, Penn.	1.10	1.00				
CENTRAL:						
Aurora, Ill.		.40@ .50	.40	.50	.70	.70
Algonquin and Beloit, Wis.	.50	.40	.60	.60	.60	.60
Appleton and Mankato, Minn.		.45	1.25	1.25	1.25	1.25
Attica, Ind.			All sizes .75@.85			
Barton, Wis.		.50	.75	.75	.75	.75
Chicago district, Ill.	.70	.55	.55	.60	.60	.60
Columbus, Ohio¶		.75	.75	.75	.75	
Des Moines, Iowa	.40	.40	1.40	1.40	1.40	1.40
Eau Claire and Chippewa Falls, Wis.		.40	.65@1.00	1.00	.90	
Elkhart Lake, Wis.	.45	.30	.40	.50	.50	.50
Ferrysburg, Mich.		.50@ .80	.60@1.00	.60@1.00		.50@1.25
Ft. Dodge, Iowa	.85	.85	2.05	2.05	2.05	2.05
Grand Haven, Mich.		.60@ .80	.70@ .90	.70@ .90		.70@ .90
Grand Rapids, Mich.		.50		.80	.80	.70
Hamilton, Ohio		1.50*	1.50*	1.50*	1.50*	
Hersey, Mich.		.50		.70		.75
Humboldt, Iowa	.50	.50	1.50	1.50	1.50	1.50
Indianapolis, Ind.	.60	.60		.90	.75@1.00	.75@1.00
Joliet, Plainfield and Hammond, Ill.	.60	.50	.50	.60	.60	.60
Mason City, Iowa	.50@ .60	.50@ .60	1.30	1.30	1.20	1.20
Mankato, Minn.				1.25	1.25	1.25
Mattoon, Ill.	.75@ .85	.60@ .85	.85	.85	.85	.85
Milwaukee, Wis.	.96	.91	1.06	1.06	1.06	1.06
Moline, Ill.	.60@ .85	.60@ .85	1.00@1.20	1.00@1.20	1.00@1.20	1.00@1.20
Northern New Jersey	.40@ .50	.40@ .50	1.40	1.35	1.25	
Pittsburgh, Penn.	1.25	1.25	.85	.85	.85	.85
Silverwood, Ind.	.75	.75	.75	.75	.75	.75
St. Louis, Mo.	1.20	1.45	1.55a	1.45	1.45	1.45
Terre Haute, Ind.	.75	.60	.75	.75	.75	.75
Wolcottville, Ind.	.75	.75	.75	.75	.75	.75
Waukesha, Wis.		.45	.60	.60	.65	.65
Winona, Minn.	.40	.40	1.50	1.25	1.25	1.25
Zanesville, Ohio		.60	.50	.60	.80	
SOUTHERN:						
Charleston, W. Va.	1.40	1.40	1.40	1.40	1.40	1.40
Brewster, Fla.	.35@ .45		2.25			
Brookhaven, Miss.	1.25	.70	1.25	1.00	.70	.70
Chattahoochie River, Fla.		.70		1.75		
Eustis, Fla.		.50				
Ft. Worth, Texas	2.00	2.00	2.00	2.00	2.00	2.00
Knoxville, Tenn.	1.00	1.20	1.20	1.20	1.20	1.20
Macon, Ga.		.50			.90	.90
New Martinsville, W. Va.	1.00	.90@1.00		1.20@1.30		.80@ .90
Roseland, La.	.35	.25	1.25	1.25	.50	.50
WESTERN:						
Kansas City, Mo.		.70				
Los Angeles, Calif.	.40	.40	.25@1.00	.25@1.00	.25@1.00	.25@1.00
Oregon City, Ore.		1.50*	1.50*	1.50*	1.50*	1.50*
Phoenix, Ariz.	1.25	1.10	2.50	2.00	1.25	1.10
Pueblo, Colo.	.80	.60		1.20		1.15
San Diego, Calif.		.75	1.40	1.20	1.00	1.00
Seattle, Wash. (bunkers)	1.25	1.25	1.25	1.25	1.25	1.25

Bank Run Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
Algonquin and Beloit, Wis.			Dust to 3 in., .40			
Brookhaven, Miss.						.60
Burnside, Conn.	.75					
Chicago district, Ill.	.35					
Ferrysburg, Mich.						.65@1.00
East Hartford, Conn.	.75*					
Gainesville, Texas		1.00			.55	
Grand Rapids, Mich.				.50		
Hamilton, Ohio					1.00	
Hersey, Mich.				.50		
Indianapolis, Ind.			Mixed gravel for concrete work, at .65			
Lindsay, Texas		1.10			.55	
Macon, Ga.	.35					
Mankato, Minn.	.30					
Moline, Ill. (b)	.60	.60	Concrete gravel, 50% G., 50% S., 1.00			
Ottawa, Oregon, Moronts and Yorkville, Ill.			Ave. .60 per ton all sizes			
Roseland, La.					.50	
Somerset, Penn.		1.85@2.00		1.50@1.75		
St. Louis, Mo.			Mine run gravel, 1.55 per ton			
Summit Grove, Ind.	.50	.50	.50	.50	.50	.54
Winona, Minn.	.60	.60	.60	.60	.60	.60
York, Penn.	1.10	1.00				

*Cubic yd. ‡Delivered on job by truck. (a) ⅝-in. down. (b) River run. (c) 2½-in. and less. (d) Less 10c per ton if paid E.O.M. 10 days. (g) ¾-in. and less. ¶By truck only.

Core and Foundry Sands

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

City or shipping point	Molding, fine	Molding, coarse	Molding, brass	Core	Furnace lining	Sand blast	Stone sawing
Aetna, Ill.				.30@ .35			
Albany, N. Y.	2.25	2.00	2.25	1.50		3.75g	
Arenzville, Ill.	1.50@1.75			1.00			
Beach City, Ohio	1.75	1.75		1.75	1.75@2.00		
Buffalo, N. Y.	1.50	1.50		2.00@2.50			
Columbus, Ohio	1.50@2.00	1.25@1.50	2.00	.30	1.75@2.00	2.75@4.50	
Dresden, Ohio	1.50@1.75	1.25@1.50	1.50@1.75	1.00@1.25			
Eau Claire & Chippewa Falls, Wis.						3.00	
Elco, Ill.	Ground silica per ton in carloads—18.00@31.00						
Estill Springs and Sewanee, Tenn.	1.25			1.25		1.35@1.50	
Franklin, Penn.	1.75	1.75		1.75			
Kasota, Minn.							1.00
Klondike, Mo.				2.00	2.00		2.00
Mapleton Depot, Pa.	2.00	2.00		2.00	2.00	2.00	
Massillon, Ohio	2.25	2.25		2.25	2.50		
Mendota, Va.	Ground flint or silex—16.00@20.00 per ton						
Michigan City, Ind.				.30@ .35			
Millville, N. J.				1.75b		3.50	
Montoursville, Pa.				1.35@1.50			
New Lexington, O.	2.00	1.25					
Ohlton, Ohio	1.75b	1.75b		2.00b	1.75b	1.75b	
Ridgway, Penn.	1.50	1.50	1.75@2.00c				
Round Top, Md.				1.60		2.25	
San Francisco, Calif.[1]	3.50†	5.00†	3.50†	3.50@5.00†	3.50@5.00†	3.50@5.00†	
Silica, Va.	Potters' flint per ton, 9.00@10.00						
Thayers, Penn.	1.25	1.25		2.00			
Utica, Ill.	.55	.60		.75	.75		
Utica, Penn.	1.75	1.75		2.00			
Warwick, Ohio	1.50*@2.00	1.50*@2.00	1.50*@2.00	1.50*@2.00	1.50*@2.00		
Zanesville, Ohio	2.00	1.50	2.00	2.50	2.50		

*Green. †Fresh water washed, steam dried. [1]Core, washed and dried, 2.50. (b) Damp. (c) Shipped from Albany. (g) Dry.

Crushed Slag

City or shipping point	Roofing	¼ in. down	½ in. and less	¾ in. and less	1½ in. and less	2½ in. and less	3 in. and larger
EASTERN:							
Buffalo, N. Y., Emporium, Erie and Dubois, Pa.	2.25	1.25	1.25	1.25	1.25	1.25	1.25
Eastern Penn.	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Northern N. J.	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Reading, Penn.	2.50	1.00		1.25			
Western Penn.	2.50	1.25	1.50	1.25	1.25	1.25	1.25
CENTRAL:							
Ironton, Ohio	1.30*	1.80*	1.45*	1.45*	1.45*		
Jackson, Ohio	1.05*		1.30*	1.05*	1.30*	1.30*	
Toledo, Ohio	1.50	1.25	1.25	1.25	1.25	1.25	1.25
Youngst'n, O., dist.	2.00	1.25	1.35	1.35	1.25	1.25	1.25
SOUTHERN:							
Ashland, Ky.	1.45*		1.45*	1.45*	1.45*		
Ruesens, Va.	2.50	1.00	1.25	1.25	1.25	1.15	1.15
City, Ala.	2.05	.80	1.35	1.25	.90	.90	.80
Longdale, Roanoke, Ruesens, Va.	2.50	1.00	1.25	1.25	1.25	1.15	1.15
Woodward, Ala.	2.05*	.80*	1.35*	1.25*	.90*	.90*	

*5c per ton discount on terms.

Lime Products (Carload Prices Per Ton F.O.B. Shipping Point)

	Finishing hydrate	Masons' hydrate	Agricultural hydrate	Chemical hydrate	Ground burnt lime, Blk.	Ground burnt lime, Bags	Lump lime, Blk.	Lump lime, Bbl.
EASTERN:								
Berkeley, R. I.								2.00[5]
Buffalo, N. Y.		12.00	12.00	12.00			10.00	1.95[4]
Chazy, N. Y.		8.50	7.50	10.00		15.50[28]	8.50	14.00
Lime Ridge, Penn.							5.00[2]	
Pittsburgh, Penn.	12.50	8.50	8.50		9.00	11.00	8.00	
West Stockbridge, Mass.	12.00	10.00	5.60					2.00[12]
Williamsport, Penn.			10.00				6.00	
York, Penn.		9.50	9.50	10.50	8.50	10.50	8.50	1.65[7]
CENTRAL:								
Afton, Mich.							8.40	1.39
Carey, Ohio	12.50	8.50	8.50		9.00		8.00	1.50
Cold Springs, Ohio		8.50	8.50				8.00	
Cold Springs and Gibsonburg, Ohio	12.50	8.50	8.50		9.00	11.00		
Huntington, Ind.	12.50	8.50	8.50		9.00		8.00	
Luckey, Ohio	12.50							
Milltown, Ind.		8.50@10.00		10.00[9]			8.50[22]	1.35[10]
Scioto, Ohio	12.50[29]	8.50	8.50	10.00	.62½	7.50	1.50[3]	1.70[4]
Sheboygan, Wis.	11.50				9.50		9.50	
Wisconsin points[6]		11.50					9.50	
Woodville, Ohio	12.50	8.50	8.50	13.50	9.00	11.00	9.00	1.50[3]
SOUTHERN:								
Allgood, Ala.	12.50	10.00			8.50		8.50	1.50
El Paso, Texas							7.00	1.50
Graystone & Landmark, Ala.		9.00	9.00	9.00			8.00	1.35
Keystone, Ala.	12.50	9.00	9.00	9.00@10.00			8.00	1.35
Knoxville, Tenn.	20.25	9.00	8.00	8.00	8.00	1.25	8.00	1.35
New Braunfels, Tex.	18.00	12.00	10.00	12.00	10.00		9.50	
Ocala, Fla.		11.00	9.00				11.00	1.50
Saginaw, Ala.	12.50	10.00	9.00	10.00			8.50	1.50
WESTERN:								
Kirtland, N. M.							15.00	
Limestone, Wash.	15.00	15.00	10.00	15.00	16.50	16.50	16.50	2.09
Los Angeles, Calif.	19.00	19.00	14.00		16.20		12.50	2.50
Dittlinger, Tex.		12.00@13.00					9.50[8]	1.50[23]
San Francisco, Calif.	20.00	20.00	13.50	21.00			14.50[30]	2.15
Tehachapi, Calif.					11.80			
Seattle, Wash.	19.00	19.00	12.00	19.00	19.00		18.60	2.30

[2] Net ton. [3] Wooden, steel 1.70. [4] Steel. [5] Per 180-lb. barrel. [6] Dealers' prices, net 30 days less 25c disc. per ton on hydrated lime and 5c per bbl. on lump if paid in 10 days. [7] 180-lb. net barrel, 1.65; 280-lb. net barrel, 2.65. [8] To 11.00. [10] To 1.50. [12] To 3.00. [22] To 9.00. [23] To 1.60. [28] Barrels. [29] F.o.b. Woodville. [30] To 16.50.

Miscellaneous Sands

(Continued)

City or shipping point	Roofing Sand	Traction
Mapleton Depot, Penn.	1.90	2.00
Massillon, Ohio		2.00
Michigan City, Ind.		.30
Mineral Ridge, Ohio	*1.75	*1.75
Montoursville, Penn.		1.10
Ohlton, Ohio	a1.75	a1.60
Red Wing, Minn.		1.25
Round Top, Md.	2.25	1.75
San Francisco, Calif.	3.50	3.50
Thayers, Penn.		2.25
Warwick, Ohio	2.00	2.00
Zanesville, Ohio		2.50

*Wet. †Fine; coarse dry, 3.00@3.50. (a) Green.

Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point.

Baltimore, Md.:	
Crude talc (mine run)	3.00@ 4.00
Ground talc (20-50 mesh), bags	10.00
Cubes	55.00
Blanks (per lb.)	.08
Pencils and steel worker's crayons	.08
Per gross	1.00@ 1.50
Chatsworth, Ga.:	
Crude talc, grinding	5.00
Ground talc (150-200 mesh), bags	10.00
Pencils and steel worker's crayons, per gross	1.00@ 2.50
Chester, Vt.:	
Ground talc (150-200 mesh), bulk	8.00@ 9.00
Including bags	9.00@10.00
Chicago and Joliet, Ill.:	
Ground (150-200 mesh), bags	30.00
Dalton, Ga.:	
Crude talc (for grinding)	5.00
Ground talc (150-200 mesh), bags	12.00
Pencils and steel worker's crayons, per gross	1.00@ 2.50
Emeryville, N. Y.:	
(Double air floated) including bags;	
325 mesh	14.75
200 mesh	13.75
Hailesboro, N. Y.:	
Ground white talc (double and triple air floated) including bags, 300-350 mesh	15.50@20.00
Henry, Va.:	
Crude (mine run)	3.50@ 4.50
Ground talc (150-200 mesh), bulk	8.50@14.00
Joliet, Ill.:	
Ground talc (200 mesh)	*20.00@30.00†
*Off color. †White.	
Keeler, Calif.:	
Ground (200-300 mesh), bags	20.00@30.00
Natural Bridge, N. Y.:	
Ground talc (125-200 mesh), bags	10.00@15.00

Rock Phosphate

Prices given are per ton (2240-lb.) f.o.b. producing plant or nearest shipping point.

Lump Rock	
Columbia, Tenn.—B.P.L. 65-70%	3.50@ 4.50
Gordonsburg, Tenn.—B.P.L. 65-72%	3.75@ 4.50
Mt. Pleasant, Tenn.—B.P.L. 72%	5.50
Tennessee — F.o.b. mines, gross ton, unground brown rock, B.P.L. 72%	5.00
B.P.L. 75%	6.00
Twomey, Tenn.—B.P.L. 65%, 2000 lb.	8.00@ 9.00
Ground Rock (2000 lb.)	
Centerville, Tenn.—B.P.L. 65%	8.00
Gordonsburg, Tenn.—B.P.L. 65-70%	4.00@ 4.50
Mt. Pleasant, Tenn.—B.P.L. 72½%	9.50
Twomey, Tenn.—B.P.L. 65%	8.00@ 9.00

Florida Phosphate

(Raw Land Pebble)

(Per Ton)

Florida — F.o.b mines, gross ton, 68/66% B.P.L., Basis 68%	3.25
70% min. B.P.L., Basis 70%	3.75

Mica

Prices given are net, f.o.b. plant or nearest shipping point.

Pringle, S. D.—Mine run, per ton	125.00
Punch mica, per lb.	.06
Scrap, per ton, carloads	20.00
Rumney Depot, N. H.—Per ton,	
Mine run	360.00
Clean shop scrap	25.00
Mine scrap	22.00
Roofing mica	30.00
Punch mica, per lb.	.12

Cut mica—50% from Standard List.

Special Aggregates

Prices are per ton f.o.b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco-chips
Barton, Wis., f.o.b. cars	.....	10.50
Brandon, Vt. — English pink, English cream and coral pink	*11.00	*11.00
Brandon grey	*11.00	*11.00
Brighton, Tenn.—Pink..	6.00	5.00
Mixed pink and bronze	4.50@ 6.00	4.50@ 6.00
All colors, mixed sizes	3.50	3.50
Buckingham, Que.—Buff stucco dash	.....	12.00@14.00
Chicago, Ill. — Stucco chips, in sacks, f.o.b. quarries	.....	17.50
Crown Point, N. Y.—Mica spar	.....	9.00@10.00
Dayton, Ohio	.....	6.00@24.00
Easton, Penn.—Green stucco	.....	12.00@18.00
Green granite	.....	14.00@20.00
Haddam, Conn.—Felstone buff	15.00	15.00
Harrisonburg, Va.—Bulk marble (crushed, in bags)	†12.50	†12.50
Ingomar, Ohio—Concrete facings and stucco dash	.....	6.00@24.00
Middlebrook, Mo.—Red..	.....	20.00@25.00
Middlebury, Vt.—Middlebury white	‡9.00	‡9.00
Middlebury and Brandon, Vt.—Caststone, per ton, including bags	.....	5.50
Milwaukee, Wis.	.....	14.00@34.00
Newark, N. J.—Roofing granules	.....	7.50
New York, N. Y.—Red and yellow Verona	.....	32.00
Red Granite, Wis.	.....	7.50
Stockton, Calif.—"Natrock" roofing grits	.....	12.00@18.00
Tuckahoe, N. Y.—Tuckahoe white	12.00	.....
Wauwatosa, Wis.	.....	20.00@32.00
Wellsville, Colo. — Colorado Travertine Stone	15.00	15.00

*Carloads, including bags; L.C.L. 14.50.
†C.L. L.C.L. 17.00.
‡Carloads, including bags; L.C.L. 10.00.

Potash Feldspar

Auburn and Topsham, Me. — Color white; 98% thru 140-mesh bags, 22.00; bulk 19.00

Bristol, Tenn.—Color, white; analysis, K_2O, 6 to 10%; Na_2O, 2½ to 4%; SiO_2, 68 to 78%; Fe_2O_3, 12 to 20%; Al_2O_3, 16.5 to 18.5%; 99% thru 200 mesh; bulk, depending on grade..... 14.50@18.00

Brunswick, Me.—Color, white; 98% thru 140 mesh, bulk 19.00

Buckingham, Que.—Color, white, analysis, K_2O, 12-13%; Na_2O, 1.75%; bulk 9.00

De Kalb Jct., N. Y.—Color, white, bulk (crude) 9.00

East Hartford, Conn.—Color, white, 95% thru 60 mesh, bags 16.00
96% thru 150 mesh, bags 28.00

East Liverpool, Ohio—Color, white; 98% thru 200 mesh, bulk 19.35

Soda feldspar, crude, bulk, per ton.. 22.00

Glen Tay Station, Ont.—Color, red or pink; analysis, K_2O, 12.81%; crude (bulk) 7.00

Keystone, S. D.—Prime white; bulk (crude) 8.00

Los Angeles, Calif.—Color, white; analysis, K_2O, 12.16%; Na_2O, 1.53%; SiO_2, 65.60%; Fe_2O_3, .10%; Al_2O_3, 10.20%; crude 10.05

Pulverized, 95% thru 200 mesh; bags, 22.00; bulk 20.00

Murphysboro, Ill.—Color, prime white; analysis, K_2O, 12.60%; Na_2O, 2.35%; SiO_2, 63%; Fe_2O_3, .06%; Al_2O_3, 18 20%; 98% thru 200 mesh; bags, 21.00; bulk 20.00

Penland, N. C.—Color, white; crude, bulk 8.00
Ground, bulk 16.50

Tenn. Mills—Color, white; analysis K_2O, 18%; Na_2O_3, 10%; 68% SiO_2; 99% thru 200 mesh; bulk 18.00
99% thru 140 mesh, bulk 16.00

Toronto, Can.—Color, flesh; analysis K_2O, 12.75%; Na_2O, 1.96%; crude.. 7.50@ 8.00

Chicken Grits

Afton, Mich. (Limestone), per ton 1.75

Belfast and Rockland, Me.—(Limestone), bags, per ton ..... ‡10.00

Brandon and Middlebury, Vt.—Per ton 10.00

Cartersville, Ga.—(Limestone), per bag 2.00

Centerville, Iowa—(Gypsum), per ton.. 18.00

Chico, Texas — (Limestone), 100-lb. bags, per ton ..... 8.00@ 9.00

Danbury, Conn.—(Limestone), bulk.... 6.00@ 7.00

Easton, Penn.—Per ton, bulk 3.00

Joliet, Ill.—(Limestone), bags, per ton 4.50

Knoxville, Tenn.—Per bag 1.25

Los Angeles, Calif.—(Feldspar), per ton 15.00

Gypsum, Ohio—(Gypsum), per ton.... 10.00

Limestone, Wash. — (Limestone), per ton 12.50

Marion, Va.—(Limestone), bulk, 5.00; bagged, 6.50; 100-lb. bag ..... .50

Rocky Point, Va.—(Limestone), 100-lb. bags, 50c; sacks, per ton, 6.00; bulk 5.00

Seattle, Wash.—(Limestone), bulk, per ton 10.00

Warren, N. H.—(Mica), per ton..... 3.85@ 3.90

Waukesha, Wis.—(Limestone), per ton 8.00

West Stockbridge, Mass.—(Limestone), bulk ..... ‡7.50@*9.00

Wisconsin Points—(Limestone), per ton 9.00

*L.C.L. †Less than 5-ton lots. ‡C.L.

Sand-Lime Brick

Prices given per 1000 brick f.o.b. plant or nearest shipping point, unless otherwise noted.

Albany, Ga. ..... 10.00@11.00
Anaheim, Calif. ..... 10.50@11.00
Barton, Wis. ..... 10.50@13.00b
Boston, Mass. 17.00*
Brighton, N. Y. 19.75*
Brownstone, Penn. 11.00
Dayton, Ohio ..... 12.50@13.50
Detroit, Mich. ..... 13.50@15.00
Farmington, Conn. 13.00
Flint, Mich. ..... ¶12.00@17.50*
Grand Rapids, Mich. 12.50
Hartford, Conn. 14.00
Jackson, Mich. 12.25
Lakeland, Fla. ..... 10.00@11.00
Lake Helen, Fla. ..... 9.50@15.00
Lancaster, N. Y. 12.25
Madison, Wis. 12.50
Michigan City, Ind. 11.00
Milwaukee, Wis. 13.00*
Minneapolis and St. Paul, Minn. 10.00
Minnesota Transfer 10.00
New Brighton, Minn. 10.00
Pontiac, Mich. ..... 13.50@14.50
Portage, Wis. 15.00
Prairie du Chien, Wis. ..... 18.00@22.50
Rochester, N. Y. 19.75*
Saginaw, Mich. 13.50
San Antonio, Texas 16.00
Sebewaing, Mich. 12.00
Sioux Falls, S. Dak. 13.00c
South River, N. J. 14.00
Syracuse, N. Y. ..... 18.00@20.00*
Toronto, Canada ..... 13.50@16.00*
Wilkinson, Fla. ..... 12.00@16.00
Winnipeg, Canada 14.00

*Delivered on job. ¶Dealers' price. (b) Delivered to Milwaukee. (c) Delivered at yard.

Portland Cement

Prices per bag and per bbl., without bags, net in carload lots.

	Per Bag	Per Bbl.
Albuquerque, N. M.	.86¾	3.47
Atlanta, Ga.	.....	2.35
Baltimore, Md.	.....	2.25
Birmingham, Ala.	.....	2.30
Boston, Mass.	.52¾	2.13@2.23
Buffalo, N. Y.	.55	2.20@2.30
Butte, Mont.	.90¼	3.61
Cedar Rapids, Iowa	.....	2.24
Charleston, S. C.	.....	2.35
Cheyenne, Wyo.	.82¾	3.31
Cincinnati, Ohio	.58	2.32
Cleveland, Ohio	.....	2.24
Chicago, Ill.	.51¼	2.05
Columbus, Ohio	.57¼	2.29
Concrete, Wash.	.....	2.35
Dallas, Texas	.....	2.00
Davenport, Iowa	.....	2.24
Dayton, Ohio	.58¼	2.33
Denver, Colo.	.66¼	2.65
Des Moines, Iowa	.....	2.05
Detroit, Mich.	.....	2.15
Duluth, Minn.	.....	2.04
Houston, Texas	.....	2.00
Indianapolis, Ind.	.54¾	2.19
Jackson, Miss.	.....	2.50
Jacksonville, Fla.	.....	2.20
Jersey City, N. J.	.....	2.13
Kansas City, Mo.	.....	1.92
Los Angeles, Calif.	.....	2.50
Louisville, Ky.	.55½	2.22
Memphis, Tenn.	.....	2.50
Milwaukee, Wis.	.....	2.20
Minneapolis, Minn.	.....	2.12
Montreal, Que.	.....	1.36
New Orleans, La.	.....	2.20
New York, N. Y.	.48¼	1.93@2.03
Norfolk, Va.	.....	2.07
Oklahoma City, Okla.	.....	2.46
Omaha, Neb.	.....	2.36
Peoria, Ill.	.....	2.22
Philadelphia, Penn.	.....	2.11@2.21
Phoenix, Ariz.	.81½	3.26
Pittsburgh, Penn.	.....	2.04
Portland, Colo.	.....	2.80
Portland, Ore.	.....	2.60*
Reno, Nev.	.....	2.91
Richmond, Va.	.....	2.34
Salt Lake City, Utah	.70¼	2.81
San Francisco, Calif.	.....	2.21
Savannah, Ga.	.....	2.50
St. Louis, Mo.	.51¼	2.05
St. Paul, Minn.	.....	2.12
Seattle, Wash.	.....	2.65
Tampa, Fla.	.....	2.25
Toledo, Ohio	.....	2.20
Topeka, Kan.	.....	2.41
Tulsa, Okla.	.....	2.33
Wheeling, W. Va.	.....	2.12
Winston-Salem, N. C.	.....	2.62

NOTE—Add 40c per bbl. for bags.
*Less 10c 15 days.

Mill prices f.o.b. in carload lots, without bags, to contractors.

	Per Bag	Per Bbl.
Albany, N. Y.	.....	2.15
Buffington, Ind.	.....	1.80
Chattanooga, Tenn.	.....	2.45*
Concrete, Wash.	.....	2.50
Davenport, Calif.	.....	2.45
Detroit, Mich.	.....	2.15
Hannibal, Mo.	.....	1.90
Hudson, N. Y.	.....	1.75
Leeds, Ala.	.....	1.85
Mildred, Kan.	.....	2.35
Nazareth, Penn.	.....	1.95
Northampton, Penn.	.....	1.75
Richard City, Tenn.	.....	2.05
Steelton, Minn.	.....	1.85
Toledo, Ohio	.....	2.20
Universal, Penn.	.....	1.80

*Including sacks at 10c each.

Gypsum Products—CARLOAD PRICES PER TON AND PER M SQUARE FEET, F.O.B. MILL

	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco Calcined Gypsum	Cement and Gauging Plaster	Wood Fiber	White Gauging	Sanded Plaster	Keene's Cement	Trowel Finish	—Plaster Board— ¼x32x 36". Wt. 1500 lb. Per M Sq. Ft.	⅜x32x 36". Wt. 1850 lb. Per M Sq. Ft.	Wallboard, ⅜x32 or 48". Lgths. 6'-10', 1850 lb. Per M Sq. Ft.
Arden, Nev., and Los Angeles, Calif.	3.00	8.00u	8.00u	10.70u	10.70u	.....	.....	.....	.....	11.70u	.....	.....	.....
Centerville, Iowa	3.00	10.00	15.00	10.00	10.00	10.50	13.50	.....	.....	13.50	.....	.....	.....
Des Moines, Iowa	3.00	8.00	9.00	10.00	10.00	10.50	13.50	12.00	24.00	22.00	18.00	21.00	30.00
Detroit, Mich.	.....	.....	.....	.....	14.30o	12.30m	.....	m9.00@11.00o	.....	.....	.....	.....	.....
Delawanna, N. J.	.....	.....	.....	.....	.....	8.00	.....	9.00	.....	.....	.14½	.15½	30.00
Douglas, Ariz.	.....	.....	6.00	.....	.....	.....	15.00	.....	40.00	13.50	35.00	45.00	.....
Grand Rapids, Mich.	2.75	6.00	6.00	8.00	9.00	9.00	17.50	.....	24.55	20.00	.....	.....	.....
Gypsum, Ohio	3.00	4.00	6.00	8.00	9.00	9.00	20.00	7.00	27.00	19.00	.....	15.00	30.00
Los Angeles, Calif.	.....	.....	7.50@9.50	11.50y	.....	.....	.....	.....	.....	.....	.....	.....	.....
Port Clinton, Ohio	3.00	4.00	6.00	10.00	9.00	9.00	21.00	7.00	30.15	20.00	.....	20.00	30.00
Portland, Colo.	.....	.....	.....	10.00	.....	.....	.....	.....	.....	.....	.....	.....	.....
San Francisco, Calif.	.....	.....	11.65m	13.40r	14.40r	.....	15.40r	.....	.....	.....	.....	.....	.....
Seattle, Wash.	6.60	10.00	10.00	13.00	.....	.....	.....	.....	.....	.....	.....	.....	.....
Sigurd, Utah	.....	.....	.....	.....	.....	.....	.....	.....	21.50	.....	.....	.....	.....
Winnipeg, Man.	5.00	5.00	7.00	13.00	14.00	14.00	.....	.....	.....	.....	20.00	25.00	33.00

NOTE—Returnable bags, 10c each; paper bags, 1.00 per ton extra (not returnable).
*To 3.00; †to 11.00; ‖to 12.00; ‡prices per net ton, sacks extra; (a) to 25.00; (b) net; (c) gross; (d) hair fibre; (f) delivered; (h) delivered in six states; (i) delivered on job; (k) sacks 12c extra, rebated; (m) includes paper bags; (o) includes jute sacks; (r) including sacks at 15c; (s) per board (t) to 16.50; (u) includes sacks; (v) F.O.B. N. Y. C. and dealer's yard in mill locality; (x) Hardwall plaster; (y) sacks 15c extra, rebated.

Market Prices of Cement Products

Concrete Block

Prices given are net per unit, f.o.b. plant or nearest shipping point

City or shipping point	Sizes 8x8x16	8x10x16	8x12x16
Camden, N. J.	17.00		
Cement City, Mich.		5x8x12—55.00¶	
Columbus, Ohio	18.00@20.00a		
Detroit, Mich.	.16		.18
Forest Park, Ill.	18.00*	23.00*	30.00*
Grand Rapids, Mich.	15.00@16.00a		
Graettinger, Iowa	.18@ .20		
Indianapolis, Ind.	.13@ .15†		
Los Angeles, Calif.¶	5¼x3½x12—55.00	7¼x3½x12—65.00	
Oak Park, Ill.	16.00@18.00		
Olivia and Mankato, Minn.	9.50b		
Somerset, Penn.	.20@ .25		
Tiskilwa, Ill.	.16@ .18†		
Yakima, Wash.	20.00*		

*Price per 100 at plant. †Rock or panel face. (a) Face. ‡Delivered. ¶Price per 1000. (b) Per ton.

Cement Roofing Tile

Prices are net per sq. in. carload lots, f.o.b. nearest shipping point, unless otherwise stated.

Camden and Trenton, N. J.—8x12, per sq.

Red	15.00
Green	18.00
Chicago, Ill.—Per sq.	20.00

Cicero, Ill.—Hawthorne roofing tile, per sq.

	Chocolate, Red, Yellow, Gray, and Orange	Green, Blue
French and Spanish†	$11.50	$13.50
Ridges (each)	.25	.35
Hips	.25	.35
Hip starters	.50	.60
Hip terminals, 2-way	1.25	1.50
Hip terminals, 4-way	4.00	5.00
Mansard terminals	2.50	3.00
Gable finials	1.25	1.50
Gable starters	.25	.35
Gable finishers	.25	.35
*End bands	.25	.35
*Eave closers	.06	.08
*Ridge closers	.05	.06

*Used only with Spanish tile.
†Price per square.

Houston, Texas—Roofing Tile, per sq.	25.00
Indianapolis, Ind.—9x15-in.	Per sq.
Gray	10.00
Red	11.00
Green	13.00
Waco, Texas:	Per sq.
4x4	.60

Cement Building Tile

Cement City, Mich.:	Per 100
5x8x12	5.00
Grand Rapids, Mich.:	Per 100
5x8x12	8.00
5x4x12	4.50
Longview, Wash.:	Per 1000
4x6x12	52.00
4x8x12	64.00
Mt. Pleasant, N. Y.:	Per 1000
5x8x12	78.00
Grand Rapids, Mich.:	Per 100
5x8x12	7.00
Houston, Texas:	
5x8x12 (Lightweight)	80.00
Pasadena, Calif. (Stone Tile):	Per 100
3½x4x12	3.00
3½x6x12	4.00
3½x8x12	5.50
Tiskilwa, Ill.:	Per 100
8x8	15.00
Wildasin Spur, Los Angeles, Calif. (Stone-Tile):	Per 1000
3½x6x12	50.00
3½x8x12	60.00
Prairie du Chien, Wis.:	
5x8x12	82.00
5x4x12	46.00
5x8x 6 (half-tile)	41.00
5x8x10 (fractional)	82.00
Yakima, Wash. (Building Tile):	
5x8x12	.10

Cement Drain Tile

Graettinger, Iowa—5 to 36 in., per ton	8.00
Olivia and Mankato, Minn.—Cement drain tile, per ton	8.00
Tacoma, Wash.—Drain tile, per ft.:	
3 in.	.04
4 in.	.05
6 in.	.07½
8 in.	.10
Waukesha, Wis.—Drain tile, per ton	8.00

Concrete Brick

Prices given per 1000 brick, f.o.b. plant or nearest shipping point.

	Common	Face
Appleton, Minn.	22.00	25.00@40.00
Baltimore, Md. (Del. according to quantity)	15.50	22.00@50.00
Camden and Trenton, N. J.	17.00	
Ensley, Ala. ("Slagtex")	14.50	22.50@33.50
Eugene, Ore.	25.00	35.00@75.00
Friesland, Wis.	22.00	32.00
Longview, Wash.	18.00	25.00@75.00
Milwaukee, Wis.	14.00@15.00	20.00@40.00
Mt. Pleasant, N. Y.		14.00@23.00
Oak Park, Ill.		37.00@42.00
Omaha, Neb.	18.00	30.00@ 40.00
Pasadena, Calif.	10.00	
Philadelphia, Penn.	14.75	20.00
Portland, Ore.	17.50	23.00@55.00
Mantel brick—100.00@150.00		
Prairie du Chien, Wis.	14.00	22.50@ 25.00
Rapid City, S. D.	18.00	25.00@40.00
Waco, Texas	16.50	32.50@125.00
Watertown, N. Y.	20.00	35.00
Westmoreland Wharves, Penn.	14.75	20.00
Winnipeg, Man.	14.00	22.00
Yakima, Wash.	22.50	

†Gray. ‡Red. *Haydenite H. Brick.

Current Prices Cement Pipe

Prices are net per foot f.o.b. cities or nearest shipping point in carload lots unless otherwise noted.

Culvert and Sewer	4 in.	6 in.	8 in.	10 in.	12 in.	15 in.	18 in.	20 in.	22 in.	24 in.	27 in.	30 in.	36 in.	42 in.	48 in.	54 in.	60 in.
Detroit, Mich.								15.00 per ton									
Graettinger, Iowa	.04½d	.05½	.08½	.12½	.17½	.....	.40	.50	.60	.70	.....	.....	.....	.....	.....	.....	.....
Gr'nd Rapids, Mich. (b)																	
Culvert pipe	.....	.....	.....	.60	.72	1.00	1.28	1.60†	.....	1.92	2.32	3.00	4.00	5.00	6.00	.....	.....
Sewer pipe (d)	.....	.....	.....	.....	.....	.63	.....	.60†	.....	.....	.....	.58	.....	.....	.....	.....	.....
Houston, Texas	.....	.19	.28	.43	.55½	.90	1.30	.....	1.70†	2.20	.....	.....	.....	.....	.....	.....	.....
Indianapolis, Ind. (a)	.....	.....	.....	.80	.90	1.10	1.30	.....	.....	1.70	.....	2.70	.....	.....	.....	.....	.....
Longview, Wash.								Sewer pipe 40% off list; culvert—list									
Mankato, Minn. (b)	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.50	1.75	2.50	3.25	4.25	.....	.....	.....
Newark, N. J.								6 in. to 24 in., $18.00 per ton									
Norfolk, Neb. (b)	.....	.....	.....	.90	1.00	1.13	1.42	.....	.....	2.11	.....	2.75	3.58	.....	6.14	.....	7.78
Olivia, Mankato, Minn.								12.00 per ton									
Paullina, Iowa‡	.....	.....	.....	.....	.....	.....	.....	2.25	.....	2.11	.....	2.75	3.58	.....	6.14	.....	7.78
Somerset, Penn.	.....	.....	.....	.....	1.08	1.25	1.65	.....	.....	2.50	.....	3.65	4.85	7.50	8.50	.....	.....
Tacoma, Wash.	.15	.18	.22½	.30	.40	.55	.75	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Tiskilwa, Ill. (rein.) (a)	.....	.....	.....	.65	.75	.85	1.10	1.60	.....	1.90	.....	2.25	3.40	.....	5.50	.....	.....
Wahoo, Neb. (b)	.....	.....	.....	.....	1.00	1.13	1.42	.....	.....	2.11	.....	2.75	3.58	4.62	6.14	6.96	7.78
Yakima, Wash.								$10.00 per ton									

30-in. lengths up to 27-in. diam., 48-in. lengths after; (a) 24-in. lengths; (b) Reinforced; (c) Interlocking bar reinforced. (d) Eastern clay, list, 72% and 60% off.
21-in. diam. ‡Price per 2-ft. length. (d) 5-in. diam. [1]@1.08. [2]@1.25. [3]@1.65. [4]@2.50. [5]@3.85. [6]@5.00 [7]@7.50.

Recent Rock Products Prices

Beatrice, Neb. Local pit operators are reported to have raised the price of gravel to be used in cities and villages, from 70 to 90 cents a ton, an increase of 20 cents.

Chillicothe, Mo. Contract for eight cars of gravel awarded the Sampell pit at a price of $1.10 per ton at the pit.

Kalamazoo, Michigan, City contract awarded Greenville Gravel Corp, for 12,000 to 15,000 cu. yd. washed and screened gravel at $1.70 per yd. delivered. Price in 1926 reported to be $2.30 for same material.

Johnson County, Mo. Ground agricultural limestone offered through county farm bureau at $1.50 to $1.75 per ton f.o.b. any shipping point in county.

Builds New Plant at Toronto

ANNOUNCEMENT is made by Link-Belt, Limited, that Jackson-Lewis Co., Ltd., Toronto, Ont., has been appointed general contractor on the first unit of the building program of the company. The company's property is located at the corner of Eastern Ave. and Leslie St., Toronto.

For the past twelve years this company has occupied rented factories, but expansion in their manufacturing lines and in their business has made necessary the purchase of about five acres of land and the start of their building program.

The unit now in course of construction will consist of a two-story building, 80x160 ft. of buff pressed clay brick, the walls to be trimmed with Queenston limestone. The supports, of structural steel, are being supplied by McGregor & McIntyre, Ltd., of Toronto.

The first floor, on which are located the heavier machines, is to be constructed of concrete, overlaid with creosoted wood blocks, and will be at car-door height. The second floor will be constructed of British Columbia fir, laminated. The office will be located on this floor, taking up a space of 40x80 ft. A freight elevator and conveyor will handle the material between the first and second floors.

Ewart, Armer & Byam are engineers in charge of the installation.

Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

Coloring Materials for Cement Products*

By Dr. B. Brauner
Chemical Engineer, Prague, Czecho-Slovakia

THE domain of colors is a rich and varied one, yet the group of color dealers and manufacturers is even more varied. In Germany and England colors are generally handled by a chemist, whether his capacity is that of producer or dealer, for colors are mostly chemical and as such can be best handled by a chemist. Every consumer, however, cannot be a chemist and so must rely for his information on trade literature.

If all color manufacture and trade were in the hands of the chemists, many evils would be eliminated, such as the change of an originally black cement color to the shade of London fogs, or from an original red to the appearance of a bleached and rouged countenance. We would no longer frown at the sight of a building put up half a year ago with an abundance of light brown stucco over its art front, which today presents a motley face of rust brown shading into yellowish green and chocolate brown stains.

Considerable responsibility for this state of affairs is carried by the consumers, who frequently force a price to a ridiculously low figure permitting no guarantee. If the color manufacturer and dealer is to furnish a guarantee of the durability and quality of his product, he must use the best of raw materials. We are thus facing the eternal strife of the two concepts "quality" versus "price," of which the latter has so far always given way to the former in the eyes of sensible persons.

Reds

No other color in the entire range of mineral colors can show as many shades, as does the red, whose base is iron oxide. In commerce we encounter a series of widely different reds, 90% of which are not only entirely unsuitable for cement colors, but are actually harmful. The price and strength of cement products force us to accept as a fundamental principle, that the quantity of color added should be kept as low as possible.

Only two kinds of reds can be designated as first grade for our purpose: the original Spanish iron oxide and the artificial English iron oxide. Less suitable or entirely unsuitable are reds known as red clay, red bolus, red ochre, Caput-mortuum, Venetian, Pompeian, Neapolitan, Turkish, Engel-red, etc. These are made mostly from colcothar[1] with admixtures of heavy spar, gypsum, chalk or clay. All the above colors are unsuitable as cement colors, for their relatively low color value necessitates their use in large quantities, thus impairing the strength of cement mortar, and, more particularly, because they are not permanent, becoming affected by water and sunshine and forming discolorations and defective surfaces due to crystallization of salts.

Red mineral colors, which can be used in their natural state, are very rare. These are classed as *first group*, according to desirability. The only representatives of this group are the Spanish iron oxide and bolus or red earth, the latter being used mostly for "stretching" (i. e., adulterating) of rich, red colors with high yield, such as the Spanish and English reds. Finally this group also includes cinnabar, which owing to its high price cannot come into consideration as cement color. All other colors are either non-natural colors, or require some preparation before use. Even Spanish iron oxide of good quality is almost always calcined.

Spanish iron oxide is a hematite, whose color pigment is furnished by iron oxide Fe_2O_3. The weaker pigments are also represented in small quantities as hydrates, etc.

The second group of iron oxides includes those obtained by calcination i. e., heating to temperatures of 150 C. to 170 deg. C. Aside from the red stone mentioned above limonite is also used. It consists of hydrates and ferric or ferrous carbonates.

The third group includes all artificially manufactured iron oxides, which are marketed under a variety of trade names mentioned above. With the exception of the real English red, this group is unsuitable for cement coloring on account of its high content of soluble salts, though some of these colors are bright red.

Iron sulphide is used for this purpose (sulphide sands or pyrite). Heating in contact with air results in driving off sulphur dioxide, which is used for the manufacture of sulphuric acid. The residue is simply dumped or dissolved in sulphuric acid and burned with addition of sodium chloride, producing the cheap red color known as colcothar. Similarly the residues obtained by heating the rock in the manufacture of so-called Bohemian sulphuric acid were scrapped, though containing iron sulphate. The latter material later was utilized in the manufacture of vitriol (fuming sulphuric acid), the residue forming the Caput-mortuum.

In contact with air the free sulphur still remaining is changed to iron sulphate, which is washed away by rains leaving an iron oxide of a brilliant color. Caput-mortuum, which is not suitable for use as cement color, is nevertheless used for this purpose. The producers argue that the iron sulphide remaining in the residue is quantitatively washed out by rains, which is never so in practice, the quantity of soluble salts being always higher than 1½%, the allowable limit for soluble salts in cement colors. As a result of this, Caput-mortuum lowers the strength of cement mortar, contains salts soluble in water and produces undesirable unsoundness.

Finally we come to consider red iron oxides, which are the waste products of the alum manufacture. It should be noted, however, that cement products manufacturers have shown themselves very conservative with respect to these products. Their attitude is justified, as they also contain soluble sulphates, traces of free sulphuric acid and are not permanent, though highly advertised by their high yield, bright color and moderate price. These are the Pompeian, Venetian and Engel-red mentioned above.

The English iron oxides are obtained from

*Tonindustrie-Zeitung (1927), 30, 499, 500-2.

[1]By-product of sulphuric acid manufacture.

slate in Scotland which though it contains traces of iron sulphate, is entirely satisfactory for use as cement color due to the high grade processing. The entire free acid content and the soluble salts are removed with utmost care, so that English red oxides present the best colors of highest yield, yet unfortunately also command the highest price for cement products. They are dutiable as art oxides which increases their already high price. They are made in dark or light as well as flaming shades. The light English oxides permit a proportion of 1:30 (1 lb. color per 30 lb. cement), thus representing five times the yield of Spanish red. To overcome the grey pigment of cement, the cement color should be opaque and of high yield. This task is particularly difficult when the entire mass of cement is to be colored. This is encountered in the manufacture of asbestos roofing tile, where, contrary to cement roofing tile, the entire mass of asbestos cement must be penetrated, involving a relatively large consumption of color. The light English iron oxide is the only color used for this purpose today.

The Spanish red (Spanish iron oxide) has for years enjoyed a good reputation and is without equal wherever a dark red coloring is desired. The Spanish red is referred to in commerce as ferro-minimum and the richness of its brilliant red and its yield have no equal among the commercially available natural reds. The Spanish red is one of the few colors which satisfies all requirements as a cement color.

Requirements for All Colors

These requirements, which apply to all cement colors, are:

1. The colors must have a certain chemical composition and uniform quality.
2. They must be entirely free from moisture.
3. Whenever possible, they must be of mineral origin.
4. They must be guaranteed to resist light and alkalis.
5. They must be entirely free from soluble salts, so that for years after use they develop no unsoundness, cracks, stains or dullness of glossy finishes.
6. They must be entirely insoluble in water.
7. Gypsum shall not be present even in smallest quantities, as it impairs glossy finishes.
8. They must be permanent and give the same results even in strongly alkaline cements.
9. They must be pure, unadulterated, nor artificially improved, in order to retain the same bright hues after years of service.
10. They must be finely pulverized, so that they may be easily and rapidly added to cement.
11. They shall not cause a decrease in the strength of cement.

The only place of occurrence of these iron oxides is in the vicinity of Malaga in Southern Spain. They are mined similar to iron ore and contain in their original state 75 to 88% iron oxide and 5 to 10% water. Their specific gravity is 5.0 to 5.2. Two characteristic varieties are found: the bluish violet and the yellow red. The Spanish oxide should be dried before being fed to the grinding and pulverizing machinery, as aside from the hygroscopic water (physically combined water) and the water of hydration (chemically combined) it also contains some iron in the form of FeO, whose coloring power is lower than that of iron oxide. The driving off of all moisture and the change of FeO to Fe_2O_3 is produced by calcination. This is the reason why any large color dealer or manufacturer should insist on calcined iron oxides, as the oxides still containing moisture are considerably darker than the dry and their color value is lower. Spanish iron oxides are sold at a relatively low figure and have no equal among natural red colors. It is, therefore, a matter of regret that they are sometimes mixed with cheap minerals, gypsum, barium sulphate and the like or, if their yield does not correspond to that desired, "improved" by adding synthetic colors or mineral oils. It is not difficult to imagine the appearance of a roof with roofing tile of such "corrected," i. e., ruined color after one half year's service.

Quality Factors

The quality of red iron oxide colors may be judged by the following factors: the quantity of iron oxide (pigment) present; the quality of alumina (clay) and the loss on ignition (chemically combined water, organic matter, etc.). The red color is the better, the more iron oxide it contains and the lower is the alumina content and the loss on ignition. Exceptions may naturally occur. For this reason the author has taken the time to convince himself by way of experiment that a 82% Fe_2O_3 English red gave a higher yield in cement than a 92% Fe_2O_3 Spanish red. Secondary or inferior red colors, such as red earth, pompeian red, etc. contain 30 to 70% Fe_2O_3, about 15% Al_2O_3 and have a loss on ignition of about 1-10%. They color cement when used in proportions of 1:5 to 1:8, Spanish red 1:8 to 1:12, English red oxide 1:15 to 1:30.

A high grade iron oxide red for cement products should satisfy the following requirements:

1. Minimum iron oxide content 85% Fe_2O_3.
2. No adulteration with foreign substances.
3. Maximum content of chlorides and sulphates 1.5%.

To obtain different yields or shades Spanish and English oxides are mixed successfully in proportions of 80:20, 40:60 or 50:50.

Yellows or Buffs

The buffs or yellows are produced by ochre. Ochre is a product of weathering of feldspar or other rock and may, in certain cases, be considered a mineral color due to its high content of aluminum silicate. The colors vary from bright red to dull orange and brownish red according to whether the iron is present in the form of hydrates or oxides of different proportions. Manganese and basic iron sulphides may also alter the color. If calcium carbonate or organic material is present, or both the color assumes lighter or darker intermediate shades. The color of pure ochre, however, depends largely on the content of iron oxide and iron hydrate. Two groups are distinguished:

1. Yellow ochre, mixture of clay or calcium carbonate with iron hydrate.
2. Reddish ochre, which contains different quantities of iron oxide in addition to the two constituents mentioned above.

The second group rarely comes into consideration when dealing with cement colors. Of the light buffs the Spanish and French are the most popular. There are also good domestic grades of ochre, such as golden ochre, golden oxide and yellow oxide, which, however, have a somewhat lower yield. Other yellow brown ochres contain manganese. The deeper brown ochres transcend to the umber or light greenish yellow bronze ochres. The real cement yellow is best when it has a high iron hydrate content and low contents of calcium and manganese hydrate.

The most durable yellow color for cement products is burned ochre, which, however, is seldom specified. Iron hydrate is decomposed at a relatively high temperature, the water being driven off and the red iron oxide remaining, the product assuming an orange yellow to reddish color. Though this decomposition cannot take place in the cement products, it is nevertheless wise to prevent this possibility by subjecting the color to this process before use, as then natural atmospheric conditions would only raise the specific gravity of yellow cement products and increase their density. Despite this, natural ochre is most frequently used.

The greatest demand at present is for the original French ochre, "Icles" brand, bright yellow color. Mixing proportions are 1:6.

Browns

Brown is seldom used in the cement products industry, as this color is rarely called for. The main colors of this group are the umbers, which are deep ochres. The real Cyprian or Sicilian umber has a greenish color. The reddish umber is known to the trade as Copenhagen brown, the grey umber as deer brown. Caledonian brown becomes almost black with brownish tinge upon burning. The real umber has no organic constituents and is recognized by the liberation of chlorine upon heating with hydrochloric acid.

On heating pulverized umber, bright colors known as velvet brown (Sammetbraun), chestnut brown (Kastanienbraun), manganese-chestnut are formed. Some of these colors can be hardly differentiated from caput-mortuum (colcothar) and are used as such. The same browns are obtained by burning brown ochre.

Satisfactory yield and good service have

been obtained with artificial manganese oxide hydrate. Some of the other commercial brands are: Köln, Kasella, mahogany and VanDyck browns. These are not real umbers and may be produced from any brown or black coal variety containing alumina by pulverizing and drying. Their lower specific gravity distinguishes them from the real umbers. They also have lower covering value and cannot be recommended for cement products, as they have to be used in large quantities.

Ochres and umbers lower the strength of cement products. The user will find it advisable to get the more expensive, better grades of these colors, as their higher covering value will reduce the quantity to be added to cement. Mixing proportions, 1:8. The true quality of ochres and umbers can be judged only by future observations of the cement product, i. e., no unsoundness or efflorescence after a prolonged period.

Blacks

Next to red, black is the most frequently used color for cement products. Good results are obtainable with manganese black, iron oxide black and lampblack. Less suitable or entirely unsuitable is the so-called coal-black (mineral black). Among the reliable black colors, greatest use is made of natural Caucasian black (pyrolusite), which frequently contains over 90% MnO_2. The manganese black is produced from Caucasian manganese ore, which is a mixture of the two manganese oxides. The ore is ground and screened, frequently washed, and heated to convert MnO into MnO_2, which has greatest yield as cement color. Rocks considerably harder than pyrolusite are manganite, polianite, braunit, psylomelan and marcelin (Javanese manganese ore), whose grinding requires utmost care. The Javanese ore is not as costly as the Caucasian. Not all manganese ore is suitable for cement colors, as in this instance the coloring of cement depends particularly on the composition of cement. Many cements are grey or greenish grey, so that the manganese oxide should be enriched by the addition of 10-20% American lampblack. Lampblack is seldom used pure due to its high price. In making use of it, it should be guaranteed to be free from oily constituents. In a few cases coal black (mineral black) is also used. It contains over 30% bituminous coal. The best coal black is also of Spanish origin and is the more valuable the higher its carbon content, which is determined by loss on ignition. Manganese black is rated commercially in accordance with its percentage of manganese monoxide (MnO). Normal manganese oxide contains 40-70% MnO (or 50-90% MnO_2); the best, 78% MnO (corresponding to 95% MnO_2). The natural English iron oxide is a first class cement color, which produces a deep coloring of cement and has unusual yield.

The mixing proportions of cement mortar to be colored are approximately the following:

Ordinary mineral black, 1:3.

85% manganese oxide, 1:5.

95% manganese oxide, 1:10.

95% manganese oxide with 10-15% lampblack, 1:15 (lampblack fails in certain cases producing white streaks. It should be thoroughly tested).

100% chemically pure English iron oxide (Fe_3O_4), 1:25 to 1:30.

Good black cement colors are expensive and are frequently adulterated. Poor grades of manganese ore are used for this purpose being mixed with a cheap black produced by burning brewery dregs (Rebenschwarz) or with finely ground coke from gas producing plants. Such colors have no value.

Greens

Chromium green and ultramarine green are the only colors to be used for this purpose. The best and most durable is undoubtedly the real chromium green which is a relatively pure, burned chromium oxide (Cr_2O_3). A basic chromate burned with sulphur and coal with addition of potato starch is the main constituent. Gypsum is often added for "stretching" but results in unsoundness of cement. The price depends upon the chromium oxide content.

Under the trade name "chromium green" there frequently appears a mixture of Prussian blue and chromium yellow. This mixture is unstable in the presence of the alkalis which are always in cement. The green ultramarine is the best green for cement products. Its price, however, is considerably higher than that of chromium oxide. The best chromium oxides have their origin in Germany. Mixing proportions of 1:10 give good results.

Blues

Of these ultramarine blue is the best. It is composed of sodium-aluminum silicate and sodium polysulfide. It is produced during fusion of kaolin with soda and sulphur or from sodium sulphate with coal. Unadulterated ultramarine raises the strength of cement as it contains up to 70% silica soluble in hydrochloric acid. This silica readily reacts with lime to form silicates. Due to its high color value ultramarine blue is frequently adulterated with gypsum, kaolin and barytes. Mixing proportions, 1:8.

Whites

White coloring of cement products is generally produced by a coating of white cement. A light grey surface is produced by barium sulphate, better grades of lithopone and cheap grades of zinc white. Titan white is the best white pigment. Mixing proportions, 1:10.

Mixing Cement Colors

Every cement products manufacturer has, as a rule, established sources for cement, whose color is generally constant. He should also select a certain color dealer and should require a guarantee of permanence and uniformity of product.

As said above, cement colors should have highest coloring value so that the quantity added to cement can be reduced to a minimum. This results in higher strength of cement products and economy in color price. The author warns the color users from being attracted by fancy names given to colors. A common excuse advanced by some color manufacturers for poor results from their color is that the cement contains free or combined nitrates, which are to blame for the failure of the color to act properly. The cement products manufacturer, rarely versed in chemistry, is ready to believe the dealer until he learns from bitter experience that:

1. It is essential to buy colors only from well-known and technically managed firms.
2. Cement colors should not be used sparingly, as such savings result in unattractive streaks, unsoundness and cracks, discrediting the manufacturer.

The best procedure in coloring cement products is as follows:

The manufacturer frequently makes the mistake of mixing the color with the standard dark grey cement, the grey pigment absorbing a good share of the color. It is of advantage to sprinkle the wet cement mortar, consisting of portland cement and silica sand mixed in the proportions of 1:3, with a mixture of white cement and color, the white cement showing the color much better. The cement products are covered with a dry mixture of color sifted through a sieve by hand, the surface being smoothed with a steel straight-edge. This procedure of coloring and smoothing is repeated so that the final product has a color coat of from 1/16 to 3/32 in. Light and dark special cements are now manufactured for such spraying.

In conclusion we might mention two hints which may prove useful to cement products manufacturers:

Glossy Finishes for Cement Products—Fifty parts white sand and 20 parts white cement are mixed with 5-10 parts of cement color. To this is added chemically pure waterglass, until the entire mass reaches a thick pasty consistency. This can be used for glossy finishes on cement products and does not disintegrate even at temperature of 550 deg. C. The glaze shows high gloss and good color and is very effective, but is not very durable.

Prevention of Unsoundness in Cement Products—A mixture of finely ground quartz and cement in proportions of 1:10 is pulverized in a ball mill, whereby the weakly acid reaction of silica neutralizes the basic cement.

According to an American patent ½% calcium chloride may be added to a mixture of cement and color.

These specifications insure success, in spite of certain difficulties in carrying them out, and can be recommended by the author to all manufacturers of quality products.

New York State Sand and Gravel Producers Hold Enthusiastic Meeting

MEMBERS of the Empire State Sand and Gravel Producers Association met at the Colgate Inn, Hamilton, N. Y., on June 8 to further a movement for closer co-operation between the state highway department and the producers of sand and gravel. The meeting and entertainment was arranged by John G. Carpenter, president of the Madison Sand and Gravel Corp., and secretary-treasurer of the producers association.

John G. Carpenter

The Madison Sand and Gravel Corp. gave a luncheon to the members of the association and in the forenoon the visitors made a tour of the Colgate campus and inspected the Solsville plant of the local company.

At the meeting following the luncheon, G. K. Smith, president of the association, called upon the following, who responded on matters pertaining to the industry: Chas. M. Edwards, division engineer of seventh highway district, Binghamton, N. Y.; H. S. Sisson, executive secretary of the New York state highway chapter, Associated General Contractors of America, and former state commissioner of highways; W. H. Snyder, deputy U. S. highway engineer, Syracuse, N. Y.; Richard Hopkins, general manager of Albany Gravel Corp.; John G. Carpenter, president and general manager of Madison Sand and Gravel Corp.; David Hyman, president of the Buffalo Gravel Corp.; D. M. Edgerton, office manager of the seventh highway district; Wm. J. Gilmore, sales manager of the Valley Sand and Gravel Corp., Rochester.

Several speakers emphasized the desirability of closer co-operation between the state highway department and the producers of sand and gravel, and a more general use of gravel in concrete roads, and the following committee was appointed to confer with the highway department at Albany: John G. Carpenter, chairman, of Hamilton, Richard Hopkins of Albany and H. A. Stelley of Buffalo.

It also developed that there was need of a more workable and general system of inspection of coarse aggregates to insure uniformity in the various highway districts and John G. Carpenter, secretary-treasurer of the association, was directed to confer with H. S. Sisson, executive secretary of the state highway contractors association, and to ascertain the attitude of the state highway department on the matter.

The following in addition to those mentioned above participated in the meeting: C. F. Fisher, inspection engineer on concrete pavement in seventh highway district; A. D. Paine, maintenance engineer of Otsego county; Edward E. Stickney, bridge construction engineer of seventh highway district; H. D. Alexander, district manager of Link-Belt Co. of Chicago; C. I. Stratton, maintenance engineer of Chenango county; R. E. Brooks, secretary of Madison Sand and Gravel Corp.; E. J. Carlan, president of Rome Cast Stone Co.; D. M. White, sales manager of Good Roads Machinery Co. of New York City; E. L. Evans, general manager of Rome Cast Stone Co.; Nathan Oaks of Nathan Oaks and Sons, Phelps, N. Y.; J. R. Norton, sales engineer of the Smith Engineering Co., Milwaukee, Wis.; H. F. Marsh, general manager of Consolidated Materials Corp., Rochester, N. Y.; Albert Oaks of Nathan Oaks and Sons, Phelps, N. Y.; C. A. Adams, plant manager, Madison Sand and Gravel Corp., Solsville, N. Y.; E. R. Miller, manager Clean Sand Co., Boonville, N. Y.; Prof. H. O. Whitnall, treasurer of Madison Sand and Gravel Corp., Hamilton, N. Y.; L. D. Hudson, sales engineer, Symons Bros. Co., New York City; E. H. Kurtz, office manager, Madison Sand and Gravel Corp., Hamilton, N. Y.; B. G. Lucas, manager, Valley Sand and Gravel Corp., Avon, N. Y.; J. W. Robinson of Eldridge and Robinson, Auburn, N. Y.; G. W. Hinman, transportation agent for Madison Sand and Gravel Corp.; R. C. Roberts, editor of *Hamilton Republican;* H. E. Whiteside, Albany Gravel Corp.; F. A. Risley, Madison Sand and Gravel Corp.

Continued Activity in Building

A MAJOR influence in support of business has been the continued activity of building. This industry had been marked in the minds of many for a rather decided downturn this year, and the persistence with which it is holding up is causing some revision of opinion among those who have been expecting a slump in building to bring about a general recession of business activity. April figures on value of contracts awarded throughout the country were only 3% below the record sum reached in March and 6% higher than that of April a year ago. This showing makes the records of the years about equal.

Below are the figures of the F. W. Dodge Corporation comparing the contract awards for April, 1927 and 1926, by different sections of the country.

How this continued heavy building is being divided by types of construction is indication by the table comparing the classified figures of contracts awarded for the first four months of 1927 and 1926. It will be observed that residential building, though still outranking all other types, is down a little compared with a year ago, while commercial building and construction of public works and utilities, next in line in point of aggregate value, show substantial increases.

There is no doubt but that conservative business interests view continued peak building operations with considerable misgiving, knowing from past experience the tendency for movements of this kind to go too far. Stimulated by the ease with which construction can be financed, builders are constantly going ahead with new plans and finding encouragement in the facility with which finished projects are taken up. There seems to be no difficulty in filling the new buildings, with their up-to-date facilities, but it is becoming increasingly apparent that this is being done in many cases at the expense of the older ones. A certain amount of this, of course, is normal and in line with progress and the rising standard of living, but carried to extremes it is bound to have a disturbing effect on real estate values. Whatever the ultimate outcome, however, of continued active building, its immediate influence upon business is bullish by reason of the large employment it gives to labor and the heavy consumption of building materials.—*National City Bank of New York.*

Seventy-five Years of Service

ON June 1, 1927, the J. S. Schofield's Sons Co., Macon, Ga., completed a full 75 years of manufacturing and service. From a one-man organization in 1852, the company has grown to an organization of over 300 employes and to rank as one of the foremost equipment producers in the Southern States. Local business men, outside manufacturers of products distributed by the Schofield company and other friends combined their congratulatory messages in a special 20-page section, published as a supplement to the regular daily edition of the *Macon* (Ga.) *News*—a real indication of the esteem held for the Schofield company.

CLASSIFIED CONTRACT AWARDS, JANUARY TO MAY, 1927

	January 1 to May 1		
	1926	1927	% Change
Commercial buildings	$ 319,643,800	$ 342,531,400	+ 7.1
Educational buildings	101,627,600	111,257,800	+ 9.4
Hospitals and institutions	38,156,000	36,310,900	— 4.8
Industrial buildings	229,428,500	161,800,800	—29.4
Military and naval buildings	4,948,000	1,229,300	—75.1
Public buildings	15,373,200	23,896,600	+55.4
Public works and public utilities	299,463,700	334,226,300	+11.6
Religious and memorial buildings	37,968,200	51,962,600	+36.8
Residential buildings	897,569,300	848,449,400	— 5.4
Social and recreational buildings	71,373,000	91,501,700	+28.2
Total	$2,015,551,300	$2,003,166,800	— .6

CONTRACT AWARDS OF 1926 AND 1927 COMPARED

	April, 1926	April, 1927	% Change
New England States	$ 44,266,000	$ 42,537,000	— 3.9
N. Y. State and No. N. J.	170,992,700	163,570,500	— 4.3
Middle Atlantic States	56,713,600	73,244,400	+29.1
Pittsburgh District	61,853,600	84,476,300	+36.5
Central West	126,448,000	165,790,900	+31.1
Northwest	11,385,700	9,268,900	—18.5
Southeastern States	80,593,500	44,877,800	—44.3
Texas	18,360,500	20,624,900	+12.3
Total (37 states)	$570,613,600	$604,390,700	+ 5.9

Brooklyn Gravel Firms Combine to Facilitate Distribution

DISSOLUTION of the Greater New York Sand and Gravel Dealers Association coincident with the amalgamation of three of the oldest firms in the Brooklyn sand and gravel distributing industry are the current contributions to the general adjustment program that is being attempted by many parts of the building construction industry of New York City and vicinity, writes Allen E. Beals in the current *Dow Service Daily Building Reports.*

In Newark the strike of the electricians, starting May 2, ended with an advance in wages of half a dollar a day, making the wages to journeyman $12 a day and to apprentices, according to length of service, from $3 to $7 a day.

In Brooklyn, however, the readjustment program has taken a somewhat different course.

A branch of the hoisting engineers insisted upon elevating only that material above the street level which had been brought to the job by union chauffeurs. Their position was fought, but the result has been a course of action on the part of the sand and gravel distributing firms in Brooklyn whereby each is at present handling the situation as an individual problem, some having signed working contracts with the union and others are adhering to the open shop basis.

According to Joseph J. Ryan, secretary of the Ryan-Bulkley-Hickey Corp., operating 10 yards and docks in Brooklyn, Long Island City and Flushing, the amalgamation of the firms of N. Ryan Co., Washington Bulkley, Inc., and M. F. Hickey Co., established 58, 50 and 38 years respectively, resulted from certain experiences with architects and builders during the recent strike of the chauffeurs and hoisting engineers in Brooklyn, during which, it sems, it was made clear that the thing most desired was the delivery of materials on the building job without regard as to whether they were brought there by union men or not.

At the same time the union pressure on firms outside of the Greater New York Sand and Gravel Dealers' Protective Association, a credit organization, was not nearly as great as was that applied to those firms having membership in it. This pressure, it would appear, took the form of a refusal on the part of the hoisting engineers to lift any material brought to the building site other than that handled by union drivers.

"We amalgamated," said Mr. Ryan, "in the interest of cutting delivery cost and so that at the same time we could give to architects and builders the service they demanded. They insisted that deliveries of sand, gravel and cement should be such as not to cause delay in their building schedules and it has been put up to the sand and gravel dealers of Brooklyn to meet that requirement. Our method of meeting it was to amalgamate, and in doing so to make such arrangements with the union that would insure the delivery of material to job-sites without delay. We are incidentally trying to cut down haulage costs by eliminating criss-crossing of trucks in transit from yard or docks to jobs."

William B. Nallon, President of the Morgan Sand and Gravel Co., one of the members of the Greater New York Sand and Gravel Dealers' Association, looks upon the present position of the sand and gravel distributing industry of Brooklyn as one having considerable possibility for either favorable or unfavorable reaction on the building public, eventually.

"The milk in the cocoanut," he said, "is that this is a step in the direction of the five day week in the building industry.

"Situations like this one do not normally arise when the volume of building is falling off and more men are out of work.

"The unions have picked on the sand and gravel distributors because they deal with the weakest link in their membership, due to the fact that the old stiff leg derrick used for hoisting sand and gravel is being rapidly replaced by the gasoline caterpillar crane, to operate which all that is required is a license like that of a chauffer. Operators of these cranes do not have to belong to a union to operate them, and, in order to offset the loss of members in the hoisting engineers local, they have worked things around so that they are going to see that the material gets the union O. K. in the hauling."

The organization that will forthwith be dissolved had as members the Hunterspoint Lumber Supply Co., Morgan Sand and Gravel Co., B. Turecamo Co., Emmet B. Stimpson Co., Buonielo Contracting Co., M. and B. Contracting Co., Hygrade Builders Supply Co., James V. Turecamo Co., Capital Sand and Gravel Corp. and the firms that now comprise the Ryan-Bulkley-Hickey Corp.

So far as could be learned, the situation in Brooklyn does not affect the chauffeurs of the masons material dealers in that Borough, nor those in the Boroughs of Manhattan, Bronx and Queens. In Newark, where ten of the masons material dealers have declared open shop as an answer to the demand of union chauffeurs for higher wages, there has been no change.

Elvin U. Leh Retires

ELVIN U. LEH, general superintendent of the Three Forks Portland Cement Co.'s Montana plants, has submitted his resignation after 10 years of successful service in Montana, during which period he has been active not only in the cement manufacturing industry in this territory but has also contributed materially to the upbuilding and the success of other industries.

Mr. Leh's connection with the cement industry covers a period of 40 years, making him practically a pioneer in this business, which was only in its infancy when he first entered the business in Pennsylvania. Since that time he has constructed and managed plants in various parts of the United States and Canada, coming to Montana from California in the fall of 1917. While a resident of Montana he assisted in the activities of the automobile association of Gallatin county and was instrumental in aiding the passage of the bond issue for improvement of the Yellowstone trail a number of years ago.

Mr. Leh was twice elected president of the Associated Industries of Montana and devoted considerable time and effort to the upbuilding and stabilizing of the industries of the state. He has also been very active in local church work and in various civic organizations in this community so his departure will be viewed with deep regret by his many friends and business associates. He expects to sever all his connections with the cement business and devote his entire time to his interests in California.

Mr. and Mrs. Leh are expected to leave about July 1 by auto for Portland, Ore., where they will visit for a few days with their son and daughter-in-law, Mr. and Mrs. Marcus Leh, before continuing to California.

Clarke F. Leh, mechanical and construction engineer, who has also had wide experience in the cement industry has been named successor to his father and will assume his duties as superintendent here about July 1. For the past year he has assisted in the construction of the Ideal Cement Co.'s new plant, now building at Fort Collins, Colo.—*Bozeman* (Mont.) *Chronicle.*

Agstone Conference at St. Louis

THE recent limestone conference held in the Chamber of Commerce rooms in St. Louis was well attended by limestone producers and dealers, representative farmers, representatives from railroads, extension specialists, members of the soils department, county agents and vocational agriculture teachers. The purpose of the conference was to improve the supply and distribution of agricultural limestone in the eastern half of Missouri and was arranged by the St. Louis Chamber of Commerce and soils department, Missouri College of Agriculture.

New Machinery and Equipment

Tractors Reduce Operating Costs in Quarries

WITH the advent of keener competition and indications of lower margins of profit in the quarrying industry, quarry and gravel-pit owners are turning more and more to the use of traction power and have introduced tractors as a means of supplying mobile power for many operations. Tractors have been found to be particularly valuable in reducing the cost of hauling over-burden or stripping..

Fundamentally, stripping, or removing overburden in a quarry is nothing more than an excavating job in which the excavated material is all to be wasted, and as such, it involves all the problems of excavating, with some others added. But, since the business of a quarry is to produce commercial rock in prepared sizes, clean and free of dirt, the money expended in the stripping represents an operating expense which must be kept to the minimum.

In other words stripping to the quarry owners is a necessary evil which is ever present. To overcome this evil much study and experimentation have been given. The ideal quarry would be one, properly located with regard to accessibility, market, etc., of good competitive material, and which has no overburden. Unfortunately, rock does not often occur like this in nature, and so stripping is always a special problem which must be solved.

In addition to being a simple excavating problem, often in rock, the quarry stripping operation must be so conducted as to leave the rock clean, so that no dirt need be handled at the face and none get into the finished product and reduce its market value. There is also ever present the problem of disposing of the overburden, so as not to make hauls unnecessarily long, or to cover too much of the quarry property, which, when once covered by a spoil pile cannot be productive of rock.

Quarry operators, to do this work either equip themselves with excavating and hauling equipment, hire such equipment or let it out by contract, on a daily or yardage basis. In any case, the object is always to get the work done as cheaply as possible; and for the contractor, if such there be, to do it at the greatest profit to himself.

Until recently in this, as in all dirt-moving work, teams, trucks, or dinkey trains were used. Recent introduction of tractors in this type of work has, however, shown some interesting results.

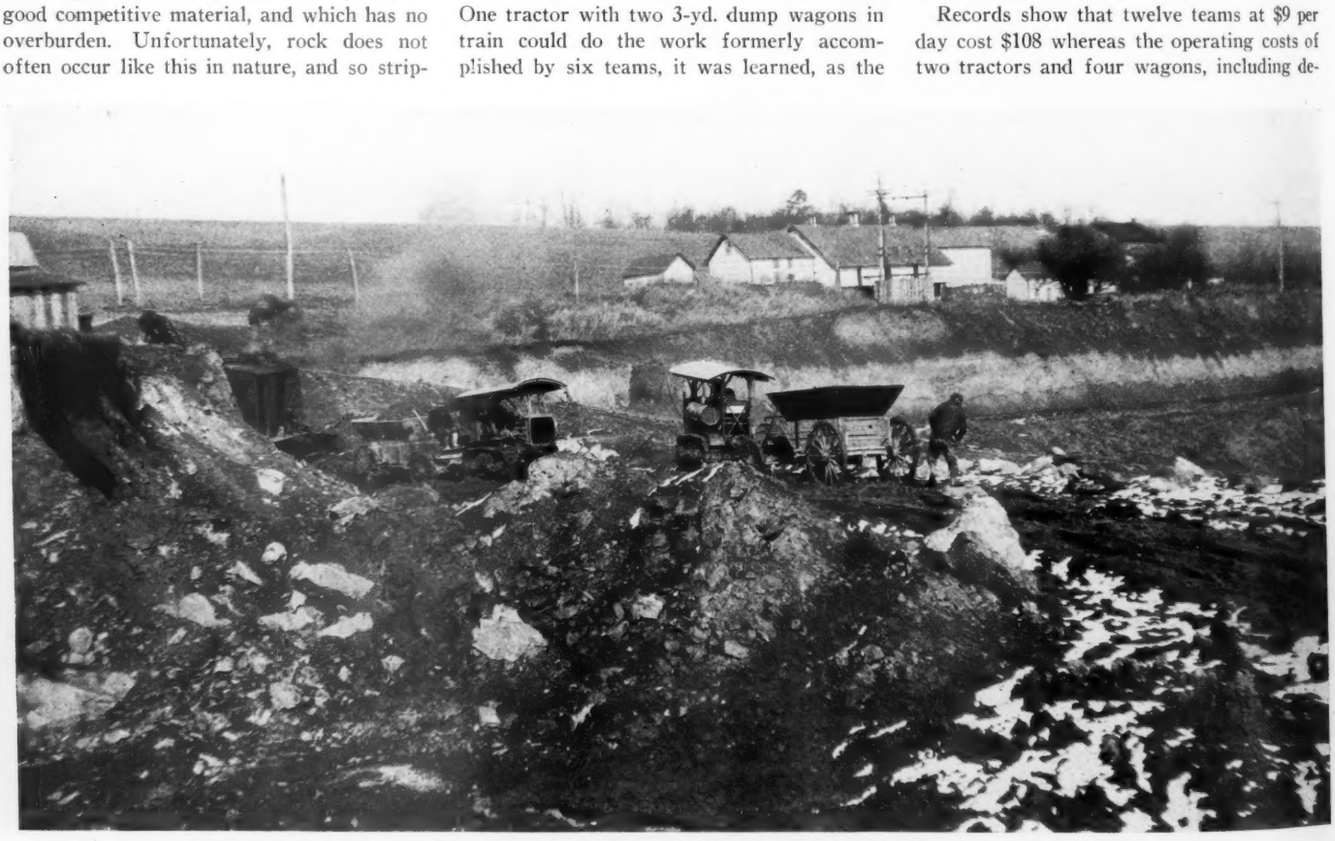
Material handled is invariably either clay, very hard when dry and extremely slippery when wet, or a mixture of this and loam. One tractor with two 3-yd. dump wagons in train could do the work formerly accomplished by six teams, it was learned, as the tractor hauled a total of 6 yd., while four teams each with a 1½-yd. wagon hauled the same amount. In addition, it is claimed that the tractor will maintain throughout the day in any kind of weather, an average speed equal to twice that of a team; so that the tractor outfit would, on this basis, replace eight teams. However, a 25% factor of safety was allowed, showing that a tractor and two 3-yd. wagons would do the work formerly done by six teams.

Test work showed also that two "Caterpillar thirties," each hauling two 3-yd. wagons will replace twelve teams, and that such an outfit could keep a ¾-yd. shovel busy on any haul up to 800 ft.

Tractors can work any day that is not too wet or too cold for men to work outside. They can operate in rain or snow, on smooth or rough ground, in mud, on the level or up a grade.

Tractors are also able to work under bad conditions around the shovel where the ground may be wet and slippery, and are able to pull a full load away. It has been found also that where severe grades are encountered in the waste or spoil bank, tractors can pull the full load whereas it is necessary to cut down on the wagon loads when teams are used.

Records show that twelve teams at $9 per day cost $108 whereas the operating costs of two tractors and four wagons, including de-



Tractors operating in the H. E. Millard quarry, Annville, Penn.

Tractor train in operation

Tractor working in snow

preciation, interest, operators' wages, gas, oil grease, waste, maintenance and other times were $46.50, resulting in a saving of $61.50 per operating day.

In arriving at this figure, the tractor is depreciated in four years and the wagons in two years. A basis of 150 working days was used in arriving at the figure of $46.50, and it is contended that at this rate of saving the tractor equipment will practically pay for itself in the 150 working-day period.

Experiments also revealed that two tractor-trains of two wagons each would do the same amount of work as four 3½-ton trucks, giving an all-weather advantage of operation as tractors can negotiate heavy mud. As with teams, tractors require fewer operators than four trucks thereby reducing the human element as well as the cost.

It was found also that tractors with load can negotiate a much steeper grade, and thereby the length of haul can be reduced, as tractor-trains can take a more direct route up steeper roads to the dump. Road maintenance is not a problem with tractors, as these machines can negotiate rough roads without difficulty.

Cost figures show that four trucks at a rental of $25 per day cost $100 per day for operation, whereas the cost of two tractors and four wagons is $46.50 per day, a saving of $53.50 per operating day.

It has been found also that tractors will successfully do the work formerly done by use of dinkey, track and cars. In many instances, the railroad equipment is being replaced with tractors as a means of hauling overburden because of economies involved. Dinkeys and cars cannot operate successfully on more than 5% grade, whereas tractors can negotiate a 15% grade.

Capital investment and operation expenses are lower with tractors, and the mobility of this equipment makes for increased production.

Tractors have been introduced in a number of Pennsylvania and Ohio quarries and are being used for stripping operations.

New Magnetic Switch

TO meet the demand for a smaller and cheaper magnetic switch with temperature overload relays, the General Electric Co. has designed a device bearing the designation CR-7006-D-20. This switch requires a very small mounting space, has a particularly neat appearance both inside and outside, and has many desirable electrical features.

The enclosing case is of the drawn-shell type, both box and cover being of the same dimensions. The cover hooks over two pins at the top and is fastened by means of a screw at the bottom. During installation the base is removed from the case, thus making it easier to fasten the case to its mounting, to install the conduit and pull in the leads.

Very large barriers are used, permitting the switch to interrupt extremely high currents. The electrical interlock is so designed that, by removing a wire from the back of the base, it is possible to use the switch on insulated circuits. Overload protection is provided by means of a Trumbull relay held in position on the panel by fuse clips. These relays can easily be changed to suit the size of motors involved. The relays are self-resetting and therefore the switch can be used with three-wire circuit (push-button) control only.

Reduced Prices on Auto-Valve Lightning Arresters

A GENERAL price reduction in auto-valve lightning arresters, effective June 10, is announced by the Westinghouse Electric and Manufacturing Co., East Pittsburgh, Penn.

According to G. A. Sawin, Westinghouse distribution apparatus manager, the price cut has been made possible by the rapid increase in the demand for lightning arresters, particularly the increasing popularity of high voltage station type arresters, and the more general use of the distribution arresters, enabling the company to produce them in quantities that permit a reduction in unit cost.

The price reductions announced include a 10% reduction in high voltage station type lightning arresters; a reduction of 5% in low voltage station arresters of 73 Kv. and less, and a cut of from 3% to 7% in type LV distribution a.c. arresters.

Steam shovel loading a tractor train

Tractor train used in a quarry stripping operation

News of All the Industry

Incorporations

Jerome Sand and Gravel Co., Jamaica, N. Y., $25,000. N. M. Pette of Jamaica.

Tasco Asphalt Co., Inc., Newark, N. J., $100,000. Deal in asphalt and cement products.

Seguine-Jersey Sand Co., Kenvil, N. J., $125,900. (King and Vogt, Morristown, N. J.)

Concrete Products Corp., Dover, Del., $100,000. Deal in concrete, sand and lime products.

Baas Rock Co., Inc., Miami, Fla. C. F. Turner and M. E. Turner.

Monarch Rock and Gravel Co., Monrovia, Calif., $100,000. Francis E. McDonald, O. B. Howell and Edna G. Langdon.

Jourdan Concrete Pipe Co., Selma, Calif., $100,000. Iredell Jourdan, Wm. T. Chutter and Harold W. Chutter.

Ripton Crushed Stone Corp., Rochester, N. Y., 250 shares of common stock. (Warren, Schuster and Case, Rochester, N. Y.)

Southern Land and Gravel Co., Inc., New York, N. Y., has increased its capital stock from 1000 shares to 4000 shares of no par value.

Greenlaw Gravel Co., Kentwood, La., $20,000. Ashleigh Harleston, Thos. G. Womack and Lord Harleston.

North Milwaukee Lime and Cement Co., Granville, Wis., has increased its capital stock from $35,000 to $50,000.

A. J. Reiske and Sons Co., Milwaukee, Wis. Produce and sell sand, gravel, etc. Albert J. Reiske, Frank Reiske and Norbert Reiske.

Kalamazoo Cement Products Co., Kalamazoo, Mich., has increased its capital stock from $15,000 to $25,000.

Stone Products Co., Inc., Shreveport, La., 1000 shares of no par value. R. H. Allison, J. D. Wilkinson and Miss Zula Porter.

Norfolk Cement Products Co., Inc., Norfolk, Va., has changed its name to the Line Tile Co., Inc., H. C. Line, president; A. W. Line, secretary.

Virginia Beach Sand Co., Inc., Norfolk, Va., $500 to $3000. Produce and sell sand and gravel. Arthur P. Jones, W. Barham Jones and W. R. Ashburn, all of Virginia Beach.

Hedstreet Construction Co., 9204 Commercial avenue, Chicago, Ill., $5000. Manufacture and sell concrete blocks, sewer pipe, etc. I. N. Nelson, S. Edward Streeter and F. T. Carver.

Sheet Concrete Pavement Corp. of America, Manhattan, N. Y., $200,000. Manufacture cement, plaster and lime, deal in inventions, patents, etc.

Malden Crushed Stone Co., Inc., Saugus, Mass., $35,000. Quarry and crush stone. Michael and John H. McDonough, both of Swampscott, and Walter F. Delano of Salem.

Arkansas Portland Cement Co., Little Rock, Ark., 10,000 shares no par value and $2500 paid in capital. Manufacture cement. C. D. Nichols and P. A. Thompson of Oklahoma City, M. O. Matthews of Ada, Okla.

Florida Travertine Corp., Bradenton, Fla., $200,000. To quarry and market travertine stone. Major Geo. L. Jones, of Bradenton and Baltimore; Geo. W. Yeoman, of Detroit; Leadley Ogden, of Sarasota; M. C. Erwin, of Sarasota; Len H. Rounds, of Sarasota; Screven Bond, Sarasota; H. F. Tinnerholm, Jacksonville; Zern Bissell, Bradenton; Wilkie J. Schall, Jacksonville, and M. O. Huck, Jacksonville.

Quarries

Charles A. Hoyt, owner of the quarry east of Au Sable Forks, N. Y., is reported to have started operations recently.

Superior Portland Cement Co., Concrete, Wash., recently set off a 20-ton charge of powder at their quarry here, loosening about 150,000 yd. of rock.

Fortson, Wash.—Plans are said to be under way to work the deposits of limestone and clay at Fortson and also later on to erect a plant.

Durham, N. C.—A new rock crusher has been installed and put in operation at the city-owned quarry.

Potsdam, N. Y.—The town council has purchased a new portable type rock crusher which it will use on road work.

Leathem D. Smith Stone Co., Sturgeon Bay, Wis., Leathem D. Smith, president, recently announced the opening of a Detroit, Mich., office and stated that the company will also open a Chicago, Ill., office soon to develop the Smith self-unloader. Major Putnam, engineer, will be connected with this office.

Perris, Calif.—W. C. Ricketas reopened the granite quarry located on the Schain property at Perris.

Brandon Rock Products Corp., Brandon, Vt., is changing its Middlebury, Vt., quarry operation from an open pit to a tunnel operation.

Washington County, Ore.—County commissioners are asking bids for crushing 8830 cu. yd. of rock at the Hazedale quarry. Crushing plant will be furnished and installed by Washington County. The work involved covers the quarrying and crushing of surfacing materials.

Sand and Gravel

Swainsboro, Ga.—A large deposit of gravel has been found near here which will be developed in the near future. Options on the property have been sold and machinery is to be installed for recovering and shipping the gravel, it is stated.

Hillstrom Bros., Marshfield, Ore., are opening a new gravel plant at the mouth of the Piston river. They will furnish all the gravel for the Roosevelt highway.

Rodgers Sand Co., Pittsburgh, Penn., has plans completed for the erection of a sand and gravel handling and storage plant to be equipped with conveying, unloading and other machinery, costing approximately $250,000 complete.

Ottumwa Sand Co., Ottumwa, Iowa, has completed its new plant.

A. J. Kemper, Cedar Rapids, Iowa, has been refused permission to dredge sand and gravel from the river bed south of the 16th avenue bridge here by the zoning commission at their meeting recently.

Gurdon, Ark.—All the gravel from the Antoine and Delight pits is being used by the Missouri Pacific at their new yards in Texarkana and on the Louisiana division to repair flood damage.

Elzey Cole, Liberty Center, Ind., has started the stripping work at his new gravel pit north of Poneto.

Cement

North American Cement Corp., Albany, N. Y., was recently the host to about 350 building material merchants from Greater New York at a banquet and inspection tour of the company's cement plant at Alsen.

Associated Portland Cement Manufacturers, Ltd., Northfleet, Eng., has provided for cement storage at the Bevans Works by reinforced concrete silos, each 32x84 ft., with 2000-ton capacity.

Atlas Portland Cement Co. of Kansas, Independence, Kans., recently elected the following officers: J. R. Moran, New York City, chairman of the board of directors; W. E. Miner, New York City, re-elected president; Lowell Burch, New York, vice-president; H. E. Harding, secretary-treasurer, and J. P. Rucker of Independence, assistant secretary-treasurer.

Arkansas Portland Cement Co., Little Rock, Ark., is a new company reported to have been recently organized to manufacture portland cement. C. D. Nichols is president and P. A. Thompson is vice-president. Both are from Oklahoma City, Okla. M. O. Matthews of Ada, Okla., is secretary and treasurer of the company. The main office will be located in Little Rock, Ark.

Lawrence Portland Cement Co., Siegfried, Penn. A large order for equipment, including a rock crusher, four grinding mills (both raw and finish), two rotary kilns (200x11 ft.), a rotary cooler, four 800 hp. motors and four motor generator sets, was recently made by this company for their new plant now under construction at Thomaston, Maine.

Canada Cement Co., Ltd., Montreal, Can., announces it will soon start the preparation of plans for the construction of a gypsum crushing plant and a storage pier at Antigonish. The site is now being surveyed by S. Barr, the company's engineer.

Cement Products

Fred G. Mesler and **Chas. J. Larson**, Chicago, Ill., announce their partnership in the cement products business to be located at 1543 North Lawndale avenue, with show and sales rooms at 3501-03 West North avenue.

Cast Stone Products Co., 904 Shawano avenue, Green Bay, Wis., started operating June 6. George F. Lewis is the manager of the concrete block plant.

Maryland Concrete Corp., Baltimore, Md., is reported to have recently acquired about two acres of land at Eighth and O'Donnell streets upon which it plans to erect a concrete products plant.

Peterson and Co., San Francisco, Calif., have purchased a site in South San Francisco, Calif., and plan the erection of a $60,000 concrete block manufacturing plant, it is stated.

Toronto, Canada.—Canadian cement products manufacturers held a meeting and luncheon on June 9 to discuss the question of adopting standard sizes for their products.

Bowers Stone Manufacturing Co., 645 South Murat street, New Orleans, La., reports an increase of 40% in its business over the first five months of last year.

Bedford-Carthage Stone Corp., Houston, Texas, recently purchased about five acres of land here for the reported sum of $5806. The company plans to erect a 120x300 ft. steel factory structure on the new property at a cost of $30,000, to be used as a building stone fabrication plant. The new plant will have 600 ft. of trackage on the M. K. & T. R. R.

California Stone-Tile Co., Burbank, Calif., recently inaugurated the National Board of Fire Underwriters' inspection service at their plant as a result of the successful passing of the Underwriters' tests by their stone-tile building units. This qualifies the company to use the Fire Underwriters' label on their stone-tile units.

Miscellaneous Rock Products

Western Feldspar Milling Co., Denver, Colo.—Plans for the erection of a new 55x76 ft. grinding mill at an estimated cost of $20,000 at 1333 West Maple street were recently filed by the company.

General Mica and Clay Co., Atlanta, Ga., is said to have acquired mica properties near Franklin, N. C., which it will develop. Plans are being prepared for the installation of refining machinery, mining and power equipment, at a reported cost of $85,000.

Amiesite Asphalt Co. of Ohio, Inc., Arcade building, Cleveland, Ohio, has acquired new quarry property at Mimms near Nashville, Tenn., where it plans to build a new plant for the production of amiesite asphalt. The plant will be equipped for about a 400-ton per day capacity, at an estimated cost of $75,000. The company also plans to establish similar refining plants in Memphis and Nashville, Tenn., at a reported total cost of $200,000 with equipment.

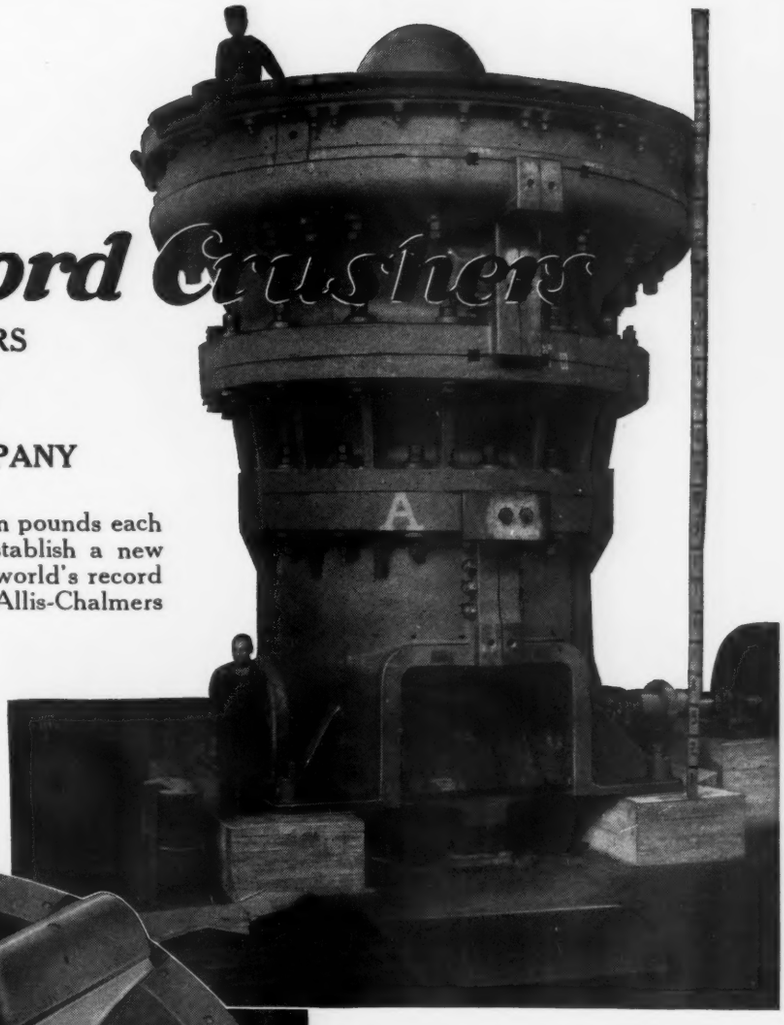
J. A. Vorhees, Oakdale, Calif., is reported to have installed equipment and plans to start asbestos mining operations near Oakdale soon. The entire output of the mine will go to the Asbestos Products Co. of Oakdale.

Keasbey and Mattison Co., Ambler, Penn., has lately acquired about 25 acres of land belonging to the Traylor Truck Corp. at Cornwalls, Penn. According to the report, the company plans to erect a factory for the Newtile Corp. of Ambler, a member of the group of asbestos industries headed by Dr. Richard V. Mattison. The new factory will be equipped to produce "Newtile," a sheet tiling, made from a base of asbestos and portland cement.

Societe de Recherches Sa Salines, Mulhouse, Alsace. This is the new company recently organized to exploit the potash and allied salts deposits in the district of Guebwiller (Haut-Rhin) Alsace. This is a limited liability company with a capital of 1,500,000 francs.

Cie Francaise des Phosphates de l'Oceanie, Makatea, Tahiti, reports increased exports of phosphates for 1926 amounting to 127,177 metric tons as compared with 81,000 tons in 1925.

World's Record Crushers



60-INCH ALLIS-CHALMERS SUPERIOR-McCULLY

All-Steel Gyratory Crushers

Built for

CHILE EXPLORATION COMPANY

Chuquicamata, Chile

These two crushers, which weigh a million pounds each and which are of all-steel construction, establish a new record for Gyratory Crushers and another world's record for the lines of heavy machinery built by Allis-Chalmers Manufacturing Company.

In spite of their extreme size and enormous weight they are sectionalized for transportation over a narrow gauge, mountain railroad to an altitude of 9200 ft. above sea level.

25 freight cars are required to handle the shipment of these two crushers and their spare parts between Milwaukee and New York.

The two hopper openings, each 5 feet across, permit a carload of ore weighing 70 tons to be dumped into the crusher at one time. Some pieces of the ore will weigh as much as seven tons. This will be reduced to a 12-inch product. Each crusher handles from 2000 to 2500 tons of ore per hour.

"The Story of the World's Record Crushers," a pamphlet telling of the problems of building and transporting these huge machines will be furnished on application to those interested. Address

Allis-Chalmers Manufacturing Co.
Dept. C-10 Milwaukee, Wis., U. S. A.

ALLIS-CHALMERS

MILWAUKEE, WIS. U. S. A.

When writing advertisers, please mention ROCK PRODUCTS

Personals

Charles S. Vance, Fort Valley, Ga., was recently promoted to the position of assistant superintendent for the Pennsylvania-Dixie Cement Corp. at Clinchfield, Ga. Major Vance has been with the company since 1923, at which time he was prospecting for the plant.

Charles E. Lind, Bellingham, Wash., president of the Lind Gravel Co., was confined to St. Joseph's hospital recently by liver trouble and complications.

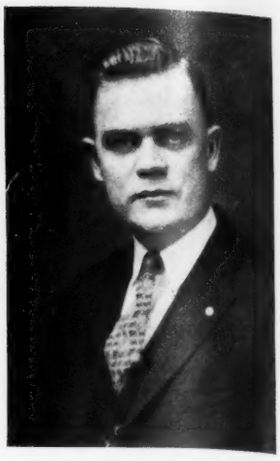
Edward M. Dutcher and **Edward S. Bixler**, officials of the Limestone Products Corp. of America of Newton, N. Y., recently sustained slight injuries when Mr. Dutcher's automobile skidded and overturned.

James Stevens, who has been connected with the Associated Portland Cement Manufacturers, Ltd., and the Cement Marketing Co., Ltd., of England, has been appointed a director in the latter company.

Irving Warner, vice-president and chief engineer of the Charles Warner Co. of Wilmington, Del., sustained injuries to his foot recently while he was at the Cedar Hollow plant inspecting some hoisting machinery.

C. S. Emert

T. W. Noble



E. F. Olson

Merger of Five Cement Products Machinery Manufacturers

ANNOUNCEMENT is made of the formation of the Consolidated Concrete Machinery Corp., capitalized at a million dollars, to conduct the businesses formerly operated by the Anchor Concrete Machinery Co., Adrian, Mich.; Ideal Concrete Machinery Co., Cincinnati, Ohio; Thomas W. Noble & Co., Chicago, Ill.; Universal Tamping Machinery Co., Peoria, Ill., and Adrian Casting Co., Adrian, Mich.

The Consolidated Concrete Machinery Corp. will operate the various production units acquired. The engineering forces and the sales department will be housed in a new office building with 6000 sq. ft. of floor space just completed at Adrian, Mich. Plans are under way for the establishment of a complete laboratory for the testing of concrete aggregates and concrete units. This service together with criticism by competent engineers in charge will be offered to the trade.

J. W. Freiberg

The officers are: President and general manager, Eugene F. Olson, formerly general manager, Anchor Concrete Machinery Co.; chairman of the board, J. W. Freiberg, formerly president, Ideal Concrete Machinery Co.; vice-president, C. F. Alderdice, president, Commercial Shearing and Stamping Co., Youngstown, Ohio; secretary-treasurer, S. S. Davenport, formerly treasurer, Anchor Concrete Machinery Co.

These officers with the following comprise the board of directors: Thomas W. Noble, Isaac Bassett, W. H. Burnham and I. C. Bradbury, Grand Rapids, Mich.

Cement Making Factories

Engineering and Equipment

Plans, Estimates, Supervision

New Plants Complete
Existing Plants Changed
Electrification of Plants
Silos—Kiln Installations
Physical and Chemical Tests of Materials
Examination of Properties—Appraisals

Cement Making Machinery

Kominuters
Trix
Exbiners
Kiln Equipment
Coolers, Pressure
Unax Coolers
Shaker Conveyors
Coal Burners
Coal Feeders
Pyrators
Silex Linings
Metal Linings
Tubemills
Washmills
Agitating Basins
Correcting Basins
Slurry Pumps
Slurry Feeders
Cradle Feeders
Table Feeders
Lenix Belt Drive
Flint Pebbles
Cylpebs
Unidan Mills

F. L. SMIDTH & CO., Inc.

ENGINEERS

50 Church Street Designers and Equippers of Cement Making Factories *Factory, Foundry and Laboratory—Elizabeth, N. J.* **New York City**